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MEDICAL ENTOMOLOGY, ITS SCOPE AND METHODS[1]

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The importance of the study of insects in many departments of human interest is being the more fully recognized as science reveals the facts of inter-relationships, both advantageous and destructive. The principal concern has been with the control of insects destructive to farm crops, and well it has been, in view of the many millions of dollars lost annually by insect ravages. Students of animal husandry and of veterinary medicine are fully awake to the losses ncurred by insect pests. Mosquitoes and flies have for centuries ast been looked upon as a source of extreme annoyance to the uman family, but that these insects might be transmitters of disease as hardly even suspected until the latter part of the last century, hen Dr. A. F. King presented his arguments before the Philosophical ociety at Washington, D. C. That insects and arachnids of a given pecies might be the sole transmitters of a specific disease and what is nore, a necessary factor, inasmuch as these insects serve as intermedi- ate hosts, was not considered seriously until the last five years of he last and the beginning of this century, when Smith and colaborat- rs showed the existing relation of the cattle tick to texas fever and Laveran, Ross, Grassi and others the rôle of mosquitoes in malaria. Today our knowledge of the transmission of diseases by insects has been greatly increased by the work of a host of investigators. Among other specific cases we know that malaria is transmitted by mosquitoes of the genus Anopheles, yellow fever by mosquitoes of the species

[1] A paper presented at the Pacific Coast Entomological Conference convened in Berkeley, California, April 20-23, 1909.

Stegomyia calopus, Bubonic plague by several species of fleas, notably the rat fleas, *Pulex cheopis* and *Ceratopsyllus fasciatus;* typhoid fever conveyed in part by the housefly, *Musca domestica,* which is also a transmitter of cholera and pretty surely of tuberculosis; anthrax by horseflies, certain forms of opthalmia by flies of the genus Hippelates, various forms of Trypanosomiasis by the stable fly (Stomoxys sp.), and the Tsétsé flies of the genus Glossina, Texas fever by the Texas fever tick (*Margaropus annulatus*). This list could be considerably increased by other references, but let us merely add to it a few examples of insects living parasitically in some form or other and producing severe and often fatal forms of irritations, such as the lice (Pediculidæ), the cone noses (Reduviidæ), the bed-bugs (Acanthidæ), the bot flies (Œstridæ), the screw worm flies (*Chrysomyia macellaria*), etc.

The facts as presented by the study of the above inter-relationships are being accepted by the medical profession of today with much less skepticism than evidenced even ten years ago. The great trouble is that the average practising physician cannot keep up with the scattered work done in this field. Several workers have attempted to place much of this material within reach of students in the same field, notably Nuttall, Braun and Osborn. To the writer it is evident that the time has come when the study of insects and their relation to disease must be placed on a more independent footing and the subject treated in a more systematic manner, in order to provide medical and veterinary students and practitioners with a better knowledge of the matter. In treating the subject of medical entomology I have departed somewhat from the usual method. Ordinarily the subject is covered in a few lectures on disease-transmitting insects in connection with general entomology or general zoölogy or parasitology, in which latter cases the habits and systematic relationships of the insects are treated more fully. There exists today rather a lack of responsibility. Whom shall we hold responsible for the study of disease-transmitting insects, the entomologist, the physician, the veterinarian or the bacteriologist? While I believe in coöperation as the solution of many scientific problems, it is also a fruitful source of disappointment since there are many important matters which are often lost somewhere between the coöperators. It may be that we should be farther along relative to preventive medicine, and particularly in regard to diseases transmitted by insects, had not phases been lost somewhere between the followers of the professions already named, each fully engaged in his own work, the duties of which are pretty well outlined. There is need of men specifically prepared, upon whom can

placed the duty and responsibility of investigation relating to the questions under consideration, men who are not only equipped entomologically, but who also have a knowledge of certain diseases and of the pathogenic organisms to be dealt with, and the laboratory methods involved. Therefore in developing the subject of medical entomology it has been my aim to construct the work from this viewpoint. That this conception seems to have met with favor by physicians and veterinarians is evident from the many opinions already voiced in many parts of this state and elsewhere.

Health officers and supervisors of hygiene have already recognized the value of such special training, and are freely calling on our department for aid and advice.

Methods

In teaching this subject, much careful attention should be devoted to the study of insect mouthparts, upon knowledge of which rests the proper interpretation of disease transmission. Enough attention must be paid to general structure to aid in classification. Internal anatomy should deal principally with the organs of digestion, including the salivary glands and canals. Usually the latter phase can be dealt with in specific cases. The importance of this knowledge should be impressed upon the mind of the student at once, and this can be made more weighty by calling attention to the widely different mouth structure of two closely related Diptera,—the housefly and the stable fly—consequently differing widely in their powers of disease transmission. By judicious lectures and demonstration covering two periods the contradistinction between bacteria and protozoa may be impressed. The various insects to be discussed may be conveniently taken up in the usual systematic order. It has been my plan to discuss family characteristics and follow this by a sub-topic, for example, "Mosquitoes and Malaria," treating the matter under several headings, *viz.*: Historical. What Is Malaria? What is the Pathogenic Organism—Its Life History? How Transmitted? Characteristics of Anopheles, Life History and Habits, Methods of Control. Thus, with necessary deviation, the list of disease-transmitting insects, including other insect and arachnid, parasites of man and domesticated animals may be considered. It is planned to segregate the subject-matter into two divisions, the medical and the veterinary, and thus we are better able to devote more attention to each subdivision. The aim of our work should never be lost sight of,—the *control* of disease-transmitting insects.

In the laboratory the insect should be studied from all possible view-

points. We need more knowledge with regard to the sensory reactions of insects, their relation to chemicals, to temperature, to light, to vibrations. We need to know more about the mouth structures, the foot structures and the actual method of disease-transmission. It is essential that the student become familiar with the habits and habitat of the insect in the field, its life history under normal and unusual conditions. This plan has been followed out in our study of the houseflies and the flesh flies, and it is upon such knowledge that our present campaign against the housefly in Berkeley rests. Thus we are also developing our work on the fleas, the mosquitoes, the fruit flies, the stable fly, and the Texas fly.

PUBLICATIONS OF THE STATION ENTOMOLOGIST

By E. Dwight Sanderson, *Director and Entomologist, N. H. Experiment Station*

The matter published by the Station Entomologist divides itself naturally into three classes—that published primarily for the information of his constituents and embodying matter which does not necessarily originate with him; second, reports of experiments and investigations made; and third, technical scientific articles. This matter is published in a variety of forms, as circulars, press circulars, bulletins, annual reports and articles in technical periodicals. The whole matter of the best methods and system for Station publications is now in such a state of development that it is impossible to lay down any principles with which all will agree, and the speaker merely wishes to attempt to outline some principles which seem to be generally supported by the Stations having the better class of publications.

First let us consider the bulletin, for it is "par excellence" the publication characteristic of the American Experiment Station. In the past the bulletin has included almost anything from a general compilation of various injurious insects, with the remedies for the same, to a bibliography of some group of insects or an account of some pest, giving its anatomy, embryology, etc. etc. More and more we have come to feel that the bulletin should be essentially a farmer's publication. In its construction the writer should constantly strive to put the matter in such shape as to attract and interest the reader. We should prefer a bulletin not over 32 pages long, certainly never over 48 pages and preferably a single form of 16 pages, except where a general handbook, such as a manual of all the insects injurious to fruits or garden crops, or something of that sort, is to be published for

reference work. The bulletins should be made as attractive as possible. This is not always within the control of the entomologist and many of the other points to be mentioned cannot always be determined by him, but if he be a man who is interested to present his work in the best form, he can usually have considerable influence over the form and make-up of his publication. The title page of many of our Station publications at once consigns them to the waste basket. The type is poorly selected and their general appearance is forbidding. One often has to study the title page before he can ascertain the subject of the bulletin. The subject should stand out distinctly and should be attractively stated. A small illustration characteristic of the subject matter adds much to the appearance.

There are a few constantly occurring classes of bulletins which merit brief comment. The bulletin which includes a discussion of a number of totally unrelated insects may be useful for reference, but in most cases the account of the various insects would be much stronger if put into separate short bulletins dealing with that pest only. This of course does not apply to bulletins dealing with the insects affecting some particular crop. Second, the bulletin which deals with the Insects of the Year. It is doubtful whether such bulletins are very generally read by the agricultural public. They are of interest and of great value to the entomologist and find a very proper place in a report or a paper before the Association of Economic Entomologists. Usually they merely serve to show what the entomologist has been doing during the year and are more or less padded in order to make some report of the entomological work during that season. The bulletin which deals exhaustively with some pest, going so far as to include its anatomy, embryology and other technical details, is probably never read by the average farmer and this wealth of technical detail merely serves to confuse him and makes it difficult for him to separate the wheat from the chaff as far as use is concerned. There are some other matters commonly included in Station bulletins which it seems to the writer might well be omitted and placed in annual reports or in technical publications. For instance, lengthy bibliographies or a list of insects is of no service whatever to the average agriculturist tho exceedingly valuable to the entomologist. One should always have in mind that these bulletins are published in large editions and that it is much better to consign such technical matter to publications printed in small editions and circulated among those whom they will benefit. These suggestions do not of course apply to bulletins which are published as those of the New York State Experiment Station, which are circulated among a com-

paratively small number of farmers and to Experiment Station workers, and which are republished in an abridged form for the general agricultural public. This ideal arrangement has not been possible as yet for most of the Stations.

If the bulletin is to be read it must be made attractive and there is very little use of printing large editions and giving them wide circulation unless they are read. With the surfeit of agricultural papers and popular magazines now to be found on the table of every farmer who reads at all, there is little chance for the station bulletin unless it be put in attractive form. One of the first considerations is typography. This, again, is not always within the control of the entomologist but he can at least prevent glaring errors. The main headings should be in type which will strike the eye and clearly subdivide the important parts of the publication. Smaller type should be used for the sub-headings and those paragraphs which it is desirable to bring forcibly to the attention of the reader. Care should be taken that headings of equal value should be in similar type. To secure uniformity in this regard the N. H. Station has recently adopted a style board or sheet showing the typography in use in its publications. This has been in use to the writer's knowledge in some other stations and is found to be exceedingly helpful in the preparation of manuscript for the printer and aids very much in securing a uniform appearance in all the publications of the station. If there be no uniform rule for all the Station's publications, the entomologist may well make up one for himself. Extremes in the use of typography are often seen, both thru lack of its appreciation as well as carrying it to excess. In some the headings are of a uniform type whether they be of more or less importance, while in others there is such a multiplicity of styles of type as to make the publication look more like an advertising sheet than a bulletin and which are decidedly unpleasing from a typography standpoint. Examples of these may easily be found but in looking over files of our publications, two have happened to particularly come to the notice of the writer. A concise, logical and well paragraphed summary printed in black face type, either at the beginning or the end of the bulletin is of great aid to the reader and will often insure a further reading of those parts of the publication in which he is interested.

Illustrations are a matter of the greatest importance in securing an attractive bulletin. Half-tones are at present the most desirable and popular form of engraving where they can be used. Half-tones should always be put on calendered paper and where many are to be used, 70 lb. super-calendered will give the best results and is the

weight used by most of the best stations. A good half-tone cannot be made from a poor photograph. If your photograph is thin, muggy and lacking detail, do not try to have it engraved, as your efforts will be doomed to failure. Again, no matter how good the photograph or engraving, if the paper be poor or if, worse, you have a poor printer, do not try to do much with half-tones. Many of our bulletins would be better without illustrations than with the ink splotches now inserted with long legends explaining to the reader that in such and such a part of the cut there is supposed to be an insect, or which totally fail to bring out the point which it is desired to illustrate. The illustrations have two purposes: First, to show the appearance of insects or plants etc., which can be more readily illustrated than described, and second, to hold the attention of the reader and reinforce the text. The American public is becoming used to reading in pictures, due to the catering of most of our leading magazines to its taste for pictures, and we may as well recognize that the average man reads as much thru the pictures as he does thru the text. If possible, have the illustrations come on the same page as the text referring to them. Very often a small illustration of some stage of the insect inserted at the point of its description in the text is much more effective than when tucked away in a plate with many other figures at the back of the bulletin. Make the legends of the figures as interesting as possible. Very often a cut may be made much more attractive by cutting out the background, especially when the background is gray and tends to obscure the main point of the illustration. Variety is given the illustration by vignetting the backgrounds which gives a pleasing contrast to the uniformity of square edged cuts. Both the cutting out of backgrounds and vignetting can be done by any good engraver but should not be attempted unless the ability of the engraver is known. Where poor paper is used and good press work cannot be secured on the text, half-tones should be put on coated paper inserts. Much better printing can be secured on such cuts, in any event, than where they are placed in the text with the type, but it is then necessary to bring the cuts together in one place rather than to distribute them thru the text as suggested above. In assembling illustrations for a full-page plate it is best to mount the prints on one sheet and have one solid plate made by the engraver, rather than a number of small cuts. To secure good printing the prints for one plate should be of about the same density, as good results will not be secured where very black and very light prints are placed together on one plate. The different figures in the plate, if it be made up of parts, are usually shown up better if a black line be run around each

and the intervening spaces be cut out so as to leave a perfectly white margin between the different parts. The lettering of figures can usually be done more neatly by the engraver's artist than by the entomologist and may be readily indicated by pasting a loose sheet of thin paper over the front of the plates and marking on it the lettering at the exact point where it is wished. Plain plates are much to be preferred to the artistic scroll work and embellishments formerly employed by some of our engravers. The plate should always be small enough so that the legend may be placed immediately beneath it. A plate put in the front of a bulletin with others scattered thru it and then the legends tucked away on the last page are inconvenient for the reader and probably very often the legends remain unread.

For very many purposes line drawings are much to be preferred to half-tones and it is to be regretted that we have become so infatuated with the ease of the photographic process that most of us decline to take the time to make presentable drawings where we do not have artists at our command. Undoubtedly a reaction in this matter will soon occur. But even with the line drawings, if they cannot be reasonably artistic they had better be omitted. The man who reads the Station publications usually has some sense of the proprieties and a crude drawing will hardly appeal to him as in keeping with the reasonable dignity which should accompany the publications of a scientist.

Arrangement.—The arrangement of the bulletin should be logical and with a natural sequence. A brief introduction pointing out the general importance of the subject considered, followed by a short historical sketch and a brief consideration of the extent of injury due to the pest, may well occupy the first page or two. The life history is generally the key to the methods of control and should follow. The various stages of the insect should be distinctly but briefly described and figured. In very many cases it will elucidate the life history to the reader if the method and place of hibernation be first described and the various stages and transformations of the insect thru the season be followed thru the summer until it again goes into hibernation. One of the things most difficult for the average man to understand is the number of generations and the transformations of an insect and this should therefore be made as clear as possible. The description of the various stages may well be placed at their respective points in the discussion of the life history, rather than being separated and the different stages described separately. The different stages of the life cycle is often made clear by an illustration such as has been frequently used by various entomologists

showing the different stages in a circle as has been done by Prof. Slingerland in the case of the Grape Leaf Hopper, by the writer with the Gipsy moth and by numerous others. The descriptions of the various stages should bring out pointedly the characteristics by which they may be recognized and should stop there. The farmer cares nothing for the technical detail and the descriptions will be of much more value to him if they merely enforce one or two points whereby that stage of the insect may be distinguished. The habits of the various stages of the insect should be described at the proper points in its life history and special emphasis should be laid upon those habits which have to do with the means of control, making them perfectly clear in the discussion of the life history and then referring back to them when considering the control. The detailed results of exhaustive studies of the time consumed in various stages etc., is not a matter of interest to most farmers. They wish to know the approximate length of the various stages as related to the means of control, and the average length of any one stage and the usual habits, except where variation due to season, climate, etc. is a matter which must be taken under consideration in control work. Such reports of exhaustive studies of the various stages of an insect may better be included in an annual report or in a technical article.

Very often a considerable portion of a bulletin is given up to a consideration of parasites and predaceous enemies. This has always seemed to the speaker to be a matter of doubtful importance to the average reader. It is undoubtedly desirable to point out that lady-bird beetles are not giving birth to plant lice upon the apple and that the fruit grower should protect them, and wherever parasites may be in any way artificially encouraged that should be mentioned and their exact importance fully outlined. But is it of any consequence whatever to enumerate the different species of parasitic insects which affect the insect and describe them with the detail usually given? Or is there any reason for publishing a description of a new species of parasite in a Station bulletin? We are coming to appreciate that in many cases parasites may be artificially encouraged and wherever that can be done it should be given due prominence, but attention constantly called to parasites in many cases leads the farmer to have an exaggerated opinion of their practical importance.

Scientific names may well be used with caution and it is a question whether it would not be better to use common names wherever possible and relegate the Latin name to a foot note where it will be available for the entomologist.

The Means of Control are of course the part of the publication

which vitally interests the farmer. Concise discussions of experiments performed may well find a place under this head, but the average reader will be satisfied with a well summarized discussion of these results and with the conclusions drawn from them fully as well as if all the data upon which they are based be submitted, for he will accept the judgement of the writer and will rarely study all the details. It is of course important that due prominence be given to these experiments as they show the experimental work done by the writer.

Under Means of Control a definite distinction should be made by headings between those which are *preventive* and those which are *remedial*. More and more we are laying emphasis on preventive measures and we should aid the reader to distinguish between prevention and remedy. Under both of these heads, sub-headings should indicate clearly against what stage of the insect the preventive or remedy is effective and the action of the preventive or remedy should be clearly explained. Definite descriptions of the use of the preventive or remedy should be given so that it may be followed easily by the reader untutored in such matters.

The bulletin may well close with a few references to the more important publications available which might be consulted by those who wish further information upon the subject in hand, but the long bibliography is of no value to the average reader. With the short bulletin, if it is well summarized, no index is usually necessary providing the different parts have been well indicated with proper type.

Spray Calendar.—A publication which has always been popular has been the spray calendar. It is a sort of farmer's encyclopedia of practical entomology and plant pathology and is one which will constantly be open to improvement. It is a question whether the original style of calendar form is the most desirable and we have noticed that many of the stations are now issuing Directions for the Treatment of Insect Pests and Plant Diseases, rather than a spray calendar. The idea that a definite calendar can be issued by which the agriculturist can fight his pests according to some rule, is an exceedingly enticing one but one which hardly tends to encourage him to secure that understanding of a pest which is necessary for its intelligent and successful control. It is the writer's belief that the form of publications now being issued by Cornell, Geneva and other stations, giving concise descriptions of the pests arranged under the crops that they attack, with brief suggestions for remedies, and then a description of the various insecticides and other means of insecticidal control, is much better than the calendar form.

A form of publication now becoming deservedly popular is the circular. This may be a brief report of some station experiments or the abstract of a bulletin, or more usually merely a short account of some pest compiled from other sources. The object of the circular is usually distinctly educational. It should be brief and written in a crisp, readable style. Only necessary illustrations should be used. The circular finds its chief usefulness for answering correspondence, where there are numerous inquiries concerning some one insect not discussed in other station publications. The circulars of the Bureau of Entomology, Colorado, New York and Ohio Experiment Stations may well illustrate a desirable type of circular, though those of the latter station are often of such a length that there seems to be no clear distinction between a circular and a bulletin.

Both bulletins and circulars are often almost wholly compiled from the writings of others, and such publications are warranted if they are needed by the station's constituents. But be generous with credit in such publications. Where the accounts of life histories and description of remedies are from some particular author and are not matters of general entomological knowledge credit them to that author and do not make it appear as original with you. Give full and generous credit to the work of assistants. No one ever belittled himself in the eyes of his colleagues by over generosity in this matter, and the man who is free with his credit never fails to receive all the recognition due him for his own work. Furthermore, recommendations are often made on the authority of another, whose efficacy is not known to the writer, and accrediting them to the original author tends to protect the writer if they do not prove satisfactory.

The Press Bulletin in one form or another is now a regular feature of some stations. In many stations the idea of the press bulletin and circular seem to have been confused. The press bulletin must be written in newspaper style if it is to command the attention of the editor and reader. It should be not over 1,000 words long, and preferably not over 600 or 700 words. Illustrations are superfluous. If the publication is designed for answering correspondence primarily make it a circular and send it to those papers which are known to desire such matter, but sending numerous so-called "press bulletins" of four pages or more to the average editor tends to discourage publication of such matter. The press bulletin may as well be printed with the same size page and type as bulletins and is then in form for binding if preservation is desired. Ordinary type is also preferable to the fine newspaper type often used. Where not over one hundred papers are to be reached the press bulletin may as well be

run off on a copying machine as to be printed. It is our custom to send out press bulletins a week ahead of the desired time of publication and to clearly state a date when they are released for publication in weeklies and dailies, thus avoiding premature publication in dailies.

Annual Reports.—Many stations are publishing only a financial and brief executive report, while others are giving a full report of the work of the various departments without any republication of bulletins. The Connecticut Station has an excellent custom of publishing its report in parts, making the reports of each department a separate portion of the annual report, so that it can be printed and circulated separately. There is a good deal of work done at every station which should be reported for the use of station workers much more fully than it is desirable to do in a bulletin, and it would seem that the station report might form a satisfactory place for a full report of the work of each department. This report may give all those scientific details, descriptions of methods used, etc., which would have no place in a bulletin for the farmer and which are not acceptable to most of the technical periodicals. The annual report need have but little reference to the popular taste; it is not prepared for the farmer. But it should be in good form and carefully organized.

The typography should be that ordinarily used in good book-making, and should merely make clear the relation of the different parts of the report without any attempt to attract the eye. The various lines of work in progress and to be reported upon should be briefly mentioned at the beginning of the report and each line of work should then be treated separately. In the discussion of an insect to be reported upon fully, its past history may well be considered in some detail, and full descriptions should be given under the various stages, with the details of its life history and a complete bibliography. In other words, a full and complete report may well be published in an annual report; but it is unnecessary to go into excessive details on any of the fine points, for even the entomologist wearies of this, and frequent summaries will command his attention and should be used freely. Tabulating the results is always helpful in placing a large amount of information in a small amount of space, where it can be readily grasped by the reader.

The illustrations in the annual report should be prepared so as to show the details of the insect under discussion and need not be prepared with any reference to their artistic effect except so far as they clearly illustrate the desired point. They may well be assembled

plates if this be more convenient and several plates may be inserted together in a report, lessening the cost of the publication.

In addition to the matter which may be published in the annual report there is often considerable technical work of the station entomologist which he wishes to publish in entomological journals or other technical periodicals. The number of such technical papers will undoubtedly increase in the future. At the New Hampshire station we have just adopted the policy of having a number of separates of such papers printed at the expense of the station and having all such papers labeled "Scientific Contributions from the N. H. Agricultural Experiment Station, No. —." The scientific articles of the station staff will be numbered serially and will be sent to the libraries of the other stations, and a select list and a number of copies will be kept and bound when a volume accumulates.

Of course it is hardly necessary to add that the natural tendency of some of us to rush into print is a matter which should always be guarded against in all of our publications. Most of us have been guilty in this regard, but there seems to be more conservatism on this point than formerly, and we trust that all may profit by the only too apparent errors of many of our colleagues in premature publications. Be absolutely sure of your conclusions before publishing them, and if the publication be merely a report of progress make it very clear that the results are merely those of one year's work, that they should not be relied upon conclusively, and do not draw undue conclusions from the work of a single season. The drawing of unwarranted conclusions from one or two years' work is not particularly a matter of publication, as it has to do with the temperament and judgment of the individual and is therefore not necessarily within the province of the speaker, but much injury has been caused in economic entomology by the over-use of printing.

As a whole, the general tone and quality of the publications of our station entomologists have made a very decided improvement in the last ten years, and in the last five years we have seen very marked advance in the quality of work, and as a consequence in the publications of our economic entomologists. We believe that this will go on and that with the large publication constantly looming up before us we shall be forced to pay more attention to the method and form of presentation.

A PARASITE ON THE ASPARAGUS BEETLE

By H. T. FERNALD, *Amherst, Mass.*

The unfortunate freedom of the asparagus beetle (*Crioceris asparagi* L.) from parasites in this country has often been remarked. It was with much interest therefore, that on June 2 of the present year the writer observed several tiny Chalcids running about on asparagus stalks, and after a few minutes observed one ovipositing in the egg of an asparagus beetle. Several of the parasites were captured and a specimen was sent to the Department of Agriculture at Washington where through the kindness of Dr. Howard and Mr. J. C. Crawford it was determined as belonging to the genus *Tetrastichus*, but in too poor condition for specific location.

The parasites are very small, measuring from two to a little less than three millimeters in length, and when seen in the sunlight as they move about are brilliant metallic green in color, particularly on the abdomen.

Their actions on the plant were carefully studied and gave the impression of stupidity on the part of the insects, for though plainly searching for beetle eggs they would frequently pass within two or three millimeters of them without being apparently aware of the fact. They would travel up and down the main stems and branches, rarely pausing, though giving no appearance of haste, often covering the same ground several times and examining eggs they had already looked over, as though entirely unaware that this was the case. They were not easily disturbed and could be closely watched with a pocket lens, the shadow caused by the head and hands of the watcher having no effect.

Apparently about one egg in every eight or ten examined proved acceptable, and the parasite after a short period (for consideration?) moved out on the egg which was long enough to permit it to support the parasite. The insect then slowly bent its abdomen and inserted its ovipositor in the egg where it remained for five or ten seconds, after which it was withdrawn and the parasite resumed its travels.

A number of eggs were seen to be punctured in this way and the parasites were by no means difficult to find for about a week. Later they disappeared, or at least none were captured till July 12, when one was captured, and others were found the following day.

At the time of the first discovery of the parasites, the asparagus beetles were abundant and eggs were extremely so. During the following month the weather was favorable for the development of these

pests and no treatment for them was applied to the field. In spite of this, the larvæ were far from abundant, and at the present writing (July 15) hardly any specimens of the insect in any stage can be found. It is probable that the pupal period for the first generation of beetles is about completed, and the reappearance of the parasites would suggest that they will be on hand for the next generation. In any case, despite a great abundance of beetle eggs in June, the larvæ were not abundant under conditions seemingly favorable in every way and it is not improbable that this was in a large measure due to the attacks of the parasite.

Similar conditions, and the presence of the parasite at Concord, Mass., accompanied by a great reduction in abundance of larvæ of the asparagus beetle there also, indicate that the parasite may be present over a considerable territory and that it may become an efficient enemy of the beetle in this country.

Comparison of specimens of the *Tetrastichus* with the descriptions of all the American species of this genus, leads the writer to the opinion that it is likely to prove undescribed, but not being familiar with the group, he has sent specimens to the Department of Agriculture for description or final identification by the specialists there.

A NEW TREATMENT FOR WIREWORMS

By H. T. Fernald, *Amherst, Mass.*

For several years wireworms have been very injurious to corn seed when first planted, in Massachusetts. Complaints of a loss of half of the area planted have been frequent, the kernels being entirely consumed by the wireworms, and in a number of cases as many as fifteen to twenty of these larvæ have been found at work close to a single seed.

An opportunity for coöperation in experiments for the control of this pest was therefore taken advantage of, and a series of tests now extending through two seasons have been made.

Crows have been a factor to consider in addition to the wireworms and were taken into consideration, but one treatment, which as far as the writer knows has never before been made use of, has proved effective for both kinds of pests, and may, in the opinion of the writer, be considered as fairly well established, if the entire success of every test made during 1908 and 1909 be regarded as sufficiently extended.

In brief the treatment consists of tarring the seed as is often done to keep crows from feeding upon it. The seed was then placed in a bucket containing fine dust and Paris green mixed in such proportions that the corn, after being shaken up in the bucket, showed a greenish color. The corn thus treated fed properly through the seeder and in every case came up satisfactorily, while check rows were badly injured. Examination of some of the corn thus treated, after about a week, showed that the wireworms were present close by the seed but that they did not molest the seed itself, apparently being repelled rather than destroyed by the treatment. It was evident that the germination of the seed was not affected, and it is probable that the Paris green was present in sufficient quantity to prove a fatal dose for crows which might attack it.

Soaking the seed in strychnine and other poisons gave far less satisfactory results than the one just given.

Further experiments may perhaps develop defects in this method, but none have as yet appeared, and it seems desirable to test it on a large scale in different parts of the country.

FUMIGATION, DOSAGE AND TIME OF EXPOSURE

By J. L. PHILLIPS, *Blacksburg, Va.*

The fumigation of nursery stock was begun in this state under the direction of Mr. W. B. Alwood in the fall of 1896, and soon came into general use in the Virginia nurseries. The fear of San Jose scale was felt very strongly during the first years of this work, and if nurserymen noticed injury from the use of this gas, our attention was not called to it. In fact, a number of nurserymen left their nursery stock exposed to the gas from 8 to 10 hours without noticing any ill effect.

A number of lots of nursery stock, infested with San Jose scale, were fumigated during these early years and examined the following summer without finding any living San Jose scale, and nurserymen and entomologists alike appear to have settled down to the conclusion that fumigation is effective, and that no injury need be expected if dormant nursery stock is fumigated according to directions usually given.

Of course every one recognizes the fact that for fumigation to be effective it must be conducted under the supervision of careful, intelligent men, who will carry out the directions in detail. Human

nature is very much the same the world over, and it requires some determination for the nurseryman in the height of the shipping season to demand that his workmen leave the fumigation house closed from 40 minutes to 1 hour, when he needs the stock to fill a number of orders, or to go through the fumigation process twice when he is quite sure the full amount of stock he has on hand can be crammed into the house at one time.

It is not surprising then that instances have come to our attention where stock that had been fumigated and set in orchards, remote from known cases of infestation with San Jose scale, develop this trouble. The fact that a large amount of adulterated potassium cyanide was on the market at that time also added to the difficulties.

Reports also began to reach us during 1903 and 1904 in regard to injury from fumigation. While we were sure, in the light of our experience in fumigation work, that some other agency was responsible for the trouble, careful tests were made during the fall of 1904, from which the conclusion was reached that nursery stock should not be injured by fumigation, as ordinarily recommended. In fact, no permanent injury to dormant trees treated with from 3 to 4 times the normal strength of gas was observed. Injury was noted in case of stone fruits, especially cherry, fumigated with the regular charge late in the spring after growth had started up. Messrs. Symons of Maryland and Burgess of Ohio carried out similar experiments about the same time with similar results.

The writer also had a large number of samples of cyanide on the market in the state during 1904 and 1905 analyzed, and found much of it to be impure. The close packing of nursery stock in the fumigation house, however, appeared to be one of the main sources of trouble. The writer's experiments on this phase of the question indicated that one could not expect fumigation to be effective against the San Jose scale on plants in the far corner of the fumigation house with an exposure of 40 minutes to this gas, even with ordinary 2 year apple stock if it is packed tightly. It also seemed impractical either to increase the charge or length of exposure to the gas sufficiently to fully compensate for the error of packing stock too tightly in the house.

Mr. Symons[1] found in his recent experiments: "That .30 grams with 30 minutes' exposure is hardly sufficient for fumigating trees known to be infested with San Jose scale (a little greater than ordinarily recommended) and that with this strength a 45 minute ex-

[1]See bulletin 131, Md. Agr. Exp. Sta., College Park, Md.

posure should be made in order that the gas may be considered a fairly sure preventive." He also reached the conclusion:

"In fumigating nursery trees at the normal recommended strength, viz, 1 ounce of cyanide to 100 cu. ft., the duration of exposure should be 1 hour, and if less time is desired the strength of the gas may be increased with perfect safety to the trees, and insure as far as possible the killing of any scale that may be present."

While we had concluded from our various experiments and observations that a 60 minute exposure is preferable to a shorter length of time in ordinary nursery work, it was decided to call attention to these facts in a circular letter to state nursery inspectors, and request from them an opinion in regard to the length of exposure. Replies were received from 29 inspectors, practically all of whom expressed the opinion that a 45 minute exposure to the ordinary strength of gas is sufficient to kill the San Jose scale under best conditions of exposure, etc. All appeared to agree also on the point that no injury need be expected to dormant nursery stock even though exposed to the gas for a much greater period.

Mr. J. A. West of Illinois called attention to injury from fumigating cherry stock both in the fall and spring. Mr. Berger states that 45 minutes' exposure to a dose of 1 ounce is injurious to citrous nursery trees, but that the trees will stand this strength of gas if the roots are covered, so as to protect them from the gas.

Of the 29 entomologists replying to the above circular, one is recommending a 30 minute exposure, twelve a 40 minute exposure, four a 45 minute exposure, two a 50 minute exposure, and five a 60 minute exposure. Several did not express themselves in letter of reply, while nine who are recommending a less exposure, stated they had about decided to recommend a 60 minute exposure, or inclined strongly towards this recommendation.

At a meeting of the American Association of Horticultural Inspectators, held in Washington, D. C. November, 1903, the 1-2-4 formula was adopted and has now come into use generally. There appears, however, to have been a lack of any very definite experiments as to the chemical combination of the materials used in generating this gas, upon which to base this recommendation.

Recent work by Mr. R. S. Woglum, of the Bureau of Entomology[2] in conjunction with the Bureau of Chemistry, appears to throw some light on the subject. From these experiments, it seems that 2 parts of water to 1 part each of acid and cyanide produces the maximum

[2]See bulletin No. 79, Bureau of Entomology, U. S. Dept. Agr.

amount of gas, but in this case the residue in the jar frequently congeals within 1 hour. It is stated however, that by using 3 parts of water the residue in the jar seldom congeals. It was found also that the greater the proportion of water used, (in addition to the maximum mentioned above) the smaller the quantity of gas evolved, until with 8 parts of water to one each of acid and cyanide less than 50 per cent. of the hydrocyanic acid passed off as gas.

As there now seems to be some definite experimental data to support the 1–1–3 formula, there appears to be no valid reason for not adopting it generally, and thus making the recommendation uniform. We prefer to state the formula in the order in which the chemicals are added, hence the change in position in the following:

Water.....3 fluid oz.
Commercial sulphuric acid (high grade 66 Beaume or 1.83 Sp. Gr.)..1 fluid oz.
Fused potassium cyanide, 98%.....1 oz.
To each 100 cubic feet of air space in the fumigating room.
The charge should remain in the room for one hour.

NURSERY INSPECTION IN LOUISIANA

By Arthur H. Rosenfeld, *Assistant Entomologist, State Crop Pest Commission of Louisiana, Baton Rouge*

Nursery conditions in the Pelican State might be described as both temperate and semi-tropical in character. The nurseries in the northern portion of the state grow such stock as apple, peach, plum, hardy hedge and ornamental plants, etc., while the majority of the nurseries in southern Louisiana grow such plants as orange, lemon, kumquat, *Ficus*, cape jasmine, pecan, etc. The insects attacking these two classes of nursery plants are quite distinct, but, as it is presumed that this discussion was intended to bring out a comparison of the methods in vogue in the various states, the writer will confine his description of inspection methods to those nurseries in which deciduous stock is grown.

Our inspections in these nurseries are made for the usual insects and plant diseases, with San José scale, of course, the principal *bête noire*. On account of our long, hot summer, nursery inspection is not begun until after July 1, as we have found that nurseries inspected earlier than this and found apparently free of infestation may, by September or October, show a comparatively heavy infestation.

The regulations of the State Crop Pest Commission require the inspection, at least once each season, of all nurseries doing business in

the state, this inspection being made without cost to the nurseryman if application for inspection is made prior to July 1. To date (July 7) sixty-seven nurserymen have requested inspection. Last season eighty-five certificates of inspection were issued, valid until September 1. We have thought best to extend the date of expiration of certificate to September 1, as a number of our pecan growers desire to ship budding wood in July and August, and, where the certificates expire July 1, they are often inconvenienced in doing so.

Another departure we have made recently from our usual course is to exempt from inspection growers of strawberry plants who sell to local trade only. We require only those growers who ship by rail or steamboat to have inspection, thus doing away with the inspection of dozens of places from which plants would be sold only to immediate neighbors. In a strawberry section like one of our main trucking regions practically every planter in the entire section will grow berries, and, if he has any surplus plants, will dispose of them to some of his neighbors. Hence our inspectors would be constantly receiving requests to inspect places from which plants would be sold, or given away, to near neighbors only. Our present method of handling these cases has greatly simplified matters.

The condition mentioned in Mr. Washburn's recent article,* regarding the difficulty of determining just what constitutes a nurseryman, arises, of course, in every state. Where a nurseryman grows just a little stock and is, in reality, a dealer, we inspect all heeling-in grounds thoroughly, and require him to file with us a list of all nurseries from which he will purchase. A certificate is then issued to him, if his place is found in proper condition and the nurseries from which he will purchase are considered up to standard, and file with us copies of their certificates of inspection. We have had very little trouble with these dealers attaching their tags to any but stock of which we have authentic knowledge.

Now as to the actual method of inspection. On account of our rather small number of nurseries we are enabled to carry out the inspection very thoroughly, and it is by no means unusual for one or two inspectors to spend from a month to six weeks in the larger of our nurseries. Naturally, if scale is brought into a nursery, it is going to come in on some of the propagating wood, and several trees of one variety which are infested are more than likely to show infestation. Hence our inspectors are instructed to inspect at right angles to the rows, crossing and re-crossing at intervals of from 12 to 15 feet, inspecting two or three trees in each row as they cross

*Jour. Econ. Ent. Vol. 11, p. 246.

In this way every variety is pretty thoroughly examined, and when any San José scale is found a tree-to-tree inspection is made of that entire variety or block. An outline of the course pursued when San José scale was found in small numbers in one of our large nurseries last season will illustrate our usual method of handling infestation.

In the first place, all centers of infestation were located carefully, and the trees within about twenty feet in every direction cut down and burned. These infestations were located by making a tree-to-tree inspection of each block in which any scale at all had been detected. About six weeks after the first inspection these blocks were again given a tree-to-tree inspection, and all infested and adjoining trees burned. Then, when shipping time arrived, the nurserymen were instructed to fumigate everything sent out, and one of our inspectors detailed to superintend the entire fumigation. The nurserymen were requested to do all digging at as nearly one time as possible, in order that our inspector would not have to spend too long a time at one place. The trees were examined by our inspector as they went into the fumigating house (built according to our directions), and any infested trees found thrown out. Fumigation with 98 per cent. KCN and C. P. sulphuric acid was insisted upon. In this manner we believe that the interests of those purchasing these trees are as thoroughly protected as is possible.

In addition to the regular inspection of nurseries our inspectors are instructed to inspect all orchards or susceptible trees within three quarters of a mile of a nursery, and where such places are found infested proper treatment is enforced.

All inspections are made by the entomologist of the State Crop Pest Commission or by his regular assistant entomologists.

Nurserymen are required to throw out all trees infested with woolly aphis, nematode root knot, crown gall, hairy root disease, etc.

Through the kindness of Dr. L. O. Howard and the chief of the Bureau of Horticulture of the New York Department of Agriculture, we have been kept notified of all foreign shipments to this state *via* the Port of New York, by which way most of our foreign shipments arrive. Most of these shipments are of bay trees (*Laurus nobilis*) and some other ornamental plants from Belgium to the New Orleans florists, and, although we have examined several thousand such plants, no trace of gypsy or brown-tail moths has been discovered. We have sent out circular letters to the nurserymen, requesting notification of the placing of all orders for foreign plants, and they have been very prompt in responding.

ADDITIONAL REARINGS IN CECIDOMYIIDAE

By E. P. FELT, *Albany, N. Y.*

The rearings of the last few months have assisted materially in clearing up certain puzzles, and have done much to support our belief in the taxonomic value of characters employed for the separation of sub-families, tribes, genera and species in this group. The numerous species of Cincticornia reared from galls on oak leaves force us to the conclusion that this genus is practically restricted to Quercus, while the many forms of Caryomyia (a new genus erected, with *Cecidomyia tubicola* O. S. as type) obtained from galls on hickory leaves compel us to believe that this group is peculiar to Carya. Furthermore, our rearings establish beyond all question the validity of the recently proposed genus Sackenomyia, erected for a single female, and enabled us to define not only both sexes but larvæ and pupæ, and to ascertain the life histories of two forms. The following brief characterizations of the additional species reared and the galls they were obtained from will suffice till more extended descriptions can be published.

Baldratia vesiculosa n. sp. was reared September 24, 1908, from scattered, oval, green swellings, 2 mm. long, on the under side of a blue-flowered aster leaf. The male is 1.75 mm. long, with unicolorous tarsi; the abdomen mostly deep orange, segments 1 to 5 being sparsely clothed with dark brown scales and narrowly margined with a few white scales. Antennal segments, 14; palpi, uniarticulate. Female 2 mm. long, with 15 antennal segments and a dark brown abdomen, with submedian silvery spots. Type Cecid. a1884.

Baldratia dumosæ n. sp. was reared July 30, 1908, from an inconspicuous yellowish brown blister gall taken by Miss Cora H. Clarke at Annisquam, Cape Ann, Mass. Female 1.75 mm. long, with unicolorous legs, and the dark brown abdominal segments narrowly margined with white. Antennal segments, 13; palpi, uniarticulate. Type Cecid. a1870a.

Baldratia waldorfi n. sp. was reared in early May, 1908, from a brown blister gall some 3 mm. in diameter, on the leaf of an unknown hairy aster. Male 2 mm. long, the legs unicolorous and the dark brown abdominal segments narrowly margined. The female with 13 and the male with 16 antennal segments, the palpi biarticulate. Type Cecid. a1824.

Baldratia nitida n. sp. was reared April 17, 1908, from a yellowish, smooth blister gall 6 to 7 mm. in diameter, on the basal leaves of aster.

female 2 mm. long, legs unicolorous, the dark brown abdominal segments narrowly margined with white. Antennæ with 21 segments; palpi biarticulate. Type Cecid. a1820.

Lasioptera clarkei n. sp. was reared January 18, 1909, from whitish, circular blister galls, some 2 to 3 mm. in diameter, on aster, taken by Miss Cora H. Clarke at Magnolia, Mass. Male 2 mm. long, the dark brown abdomen unicolorous. Antennæ fuscous yellowish, with fifteen segments, the fifth with a length one fourth greater than its diameter; female with 18 antennal segments. Type Cecid. a1901.

Lasioptera riparia n. sp. was reared April 27, 1908, from an oval or fusiform petiole or tendril gall, 1.5 mm. long, on *Vitis bicolor*, taken at Westfield, N. Y. Male 1.75 mm. long. Abdomen with the four basal segments mostly yellowish, the mesonotum shining dark brown. Antennæ with 20 segments, the 5th with a length slightly greater than its diameter. Type Cecid. a1784a.

Lasioptera danthoniæ n. sp. was reared by C. R. Crosby of Ithaca from Danthonia, taken at White Church, N. Y. Male 1.5 mm. long. Abdomen dark brown, the basal segment white, the second to fourth with submedian white spots. Antennæ with 16 segments, the fifth with a length three fourths its diameter. Type Cecid. a1925.

Lasioptera galeopsidis n. sp. was reared in June, 1900, from irregular stem galls on *Galeopsis tetrahit*, taken by Miss Cora H. Clarke at Boston, Mass. Male 1.5 mm. long. Abdomen dark brown, segments 1 to 5, with submedian white spots. Antennæ with 16 segments, the fifth with a length one fourth greater than its diameter. Female 2.5 mm. long. Antennæ with 23 segments, the fifth with a length three fourths its diameter. Type Cecid. a1965.

Lasioptera virginica n. sp. was reared February 9, 1909, from an irregular stem gall, on marsh St. Johnswort, taken by Miss Cora H. Clarke at Magnolia, Mass. Female 2 mm. long. Abdomen black, the segments with submedian white spots. Antennæ with 18 or 19 segments, the fifth with a length three fourths its diameter. Type Cecid. a1915.

Lasioptera spiræafolia n. sp. was reared July 16, 1909, from a yellowish, brown-spotted, circular blister gall, 3 mm. in diameter, on *Spiræa salicifolia* leaves, taken by Miss Cora H. Clarke at Magnolia, Mass. Male .75 mm. long, the body mostly yellowish. Antennæ dark brown, yellowish basally; 14 segments, the fifth with a length one half greater than its diameter. Type Cecid. a1860.

Lasioptera cassiæ n. sp. was reared May 6 and June 16, 1883, from irregular stem galls, 5–6 mm. long, on the sensitive plant, *Cassia nictitans*, taken by H. K. Morrison at Fort Huachua, Ariz., and placed at

our disposal through the courtesy of Doctor Howard. Male 1.5 mm. long. Abdomen dark reddish brown, the segments narrowly margined with white; antennæ with 19 segments, the fifth with a length equal to its diameter. Female 2 mm. long; antennæ with 23 to 24 segments, the fifth with a length three fourths its diameter. Type Cecid. 901.

Lasioptera murtfeldtiana n. sp. was reared September 9, 1896, from sunflower seeds taken at Kirkwood, Mo., probably by Miss Murtfeldt. The specimens were placed at our disposal through the courtesy of Doctor Howard. Male 2 mm. long; abdomen yellowish brown, the third vein uniting with costa at the distal third; legs unicolorous; antennæ with 17 segments, the fifth with a length three fourths its diameter. Type Cecid. 902.

Neolasioptera menthæ n. sp. was reared by Mr. L. H. Weld May 13 and 19 from a polythalamous mint stem gall, 6–12 mm. long, taken in the vicinity of Chicago, Ill. Male 1.5 mm. long; abdomen dark brown, the segments broadly margined posteriorly with white, those of the second to seventh broadly interrupted mesially; legs narrowly annulate with white; antennæ with 17 segments, the fifth with a length nearly equal to its diameter. Female 2.75 mm. long; abdomen dark brown, with submedian silvery spots and laterally subtriangular, white marks on segments 1 to 6; antennæ with 25 segments, the fifth with a length three fourths its diameter. Type Cecid. a1823.

Neolasioptera ambrosiæ n. sp. was reared by Mr. C. R. Crosby in January, 1909, from the stems of giant ragweed, *Ambrosia trifida*, taken at Ithaca, N. Y. Male 2 mm. long. Abdomen dark brown, with white submedian spots. Antennæ with 15 segments, the fifth with a length one fourth greater than its diameter; female 2.25 mm. long, with 17 or 18 antennal segments. Type Cecid. a1926.

Dasyneura maritima n. sp. was reared in April, 1909, from the tightly rolled terminal leaflets of the beach pea, *Lathyrus maritimus*, taken by Miss Cora H. Clarke at Magnolia, Mass. Male 1.75 mm. long. Abdomen dark brown. Antennæ with 18 segments, the fifth with a stem three fourths the length of the basal enlargement, which latter has a length one half greater than its diameter. Female 2 mm. long, with 16 to 17 antennal segments, the fifth with a length twice its diameter. Type Cecid. a1895.

Dasyneura gemmæ n. sp. was reared in late March and early April, 1909, from small conic apical bud galls on willow taken by Mr. C. P. Smith at Logan, Utah. Male 2 mm. long. Abdomen dark brown. Antennæ with 18 segments, the fifth with a stem one fourth longer than the cylindric basal enlargement. Female 2.5 mm. long. An-

ennæ with 16 segments, the fifth with a length two and one half times its diameter. Type Cecid. a1937a.

Dasyneura radifolii n. sp. was reared April 16–20, 1909, from an irregular, oval gall composed of root leaves of *Solidago puberula* or *S. juncea* taken by Miss Cora H. Clarke at Magnolia, Mass. Male 1.5 mm. long. Abdomen dark reddish brown. Antennæ with 17 segments, the fifth with a stem one fourth longer than the basal enlargement, which latter has a length two and one half times its diameter. Female 2 mm. long, with 16 antennal segments, the fifth with a length two and one half times its diameter. Type Cecid. a1911.

Dasyneura corticis n. sp. was reared by Miss Cora H. Clarke May 21, 1909, from small willow twigs taken in the Arnold arboretum at Boston, Mass. Male 2 mm. long. Abdomen dull reddish orange. Antennæ with probably 16 segments, the fifth with a stem three fourths the length of the cylindric basal enlargement, which latter has a length twice its diameter. Female 1.75 mm. long. Abdomen deep red. Antennæ with 15 segments, the fifth with a length two and one half times its diameter. Type Cecid. a1966.

Dasyneura toweri n. sp. was reared September 16 and October 20, 1908, from enlarged flower buds of *Hypericum mutilum* taken by Miss Cora H. Clarke at Magnolia, Mass. Male 2.5 mm. long. Abdomen a variable reddish. Antennæ with 19 segments, the third with a stem one fourth longer than the cylindric basal enlargement, which latter has a length twice its diameter. Female 2 mm. long, with 19 antennal segments, the fifth with a length three times its diameter. Type Cecid. a1883.

Dasyneura aromaticæ n. sp. was reared by Miss Cora H. Clarke August 23, 1908, from an ovoid, hairy, green, axillary or terminal gall, about 4 mm. in diameter, on mint taken at Barre, Mass. Male 1.25 mm. long; abdomen yellowish brown, the basal segments and genitalia fuscous; antennæ with 14 segments, the fifth with a stem as long as the basal enlargement, which latter has a length one half greater than its diameter, the third and fourth palpal segments equal. Type Cecid. a1875.

Rhabdophaga elymi n. sp. was reared January 19, 1891, from *Elymus americanus* collected at Alameda, Cal. Female 2 mm. long. Abdomen light reddish brown. Antennæ with 16 segments, the fifth with a length at least three times its diameter, the fourth palpal segment a little longer than the third. Ovipositor stout, about one fourth the length of the abdomen, the lobes broadly oval and with a length one fourth greater than the width. Type Cecid. 1044.

Rhabdophaga rileyana n. sp. was reared by the late C. V. Riley in

June and July, 1877, from a crumpled soft maple leaf. Female 1.25 mm. long. Abdomen yellowish brown. Antennæ with 15 segments, the fifth with a length twice its diameter, the fifteenth reduced, partly fused with the fourteenth, the fourth palpal segment twice the length of the third. Ovipositor about one half the length of the abdomen. Type Cecid. 1041.

Rhabdophaga latebrosa n. sp. was reared May 7, 1909, presumably from apparently normal willow buds. Male 1.5 mm. long. Abdomen yellowish brown. Wings broad, with a length only about one half greater than the width, antennal segments 17, the fifth with a stem three fourths the length of the basal enlargement, which latter has a length two and one half times its diameter, the fourth palpal segment one half longer than the third. Type Cecid. a1958.

Rhabdophaga caulicola n. sp. was reared in April, 1908, from slender willow twigs, similar to those producing *Sackenomyia packardi*, and collected by Mr. L. H. Weld at Evanston, Ill. Male 2 mm. long. Abdomen dark reddish brown. Antennæ with 18 or 19 segments, the fifth with a stem three fourths the length of the basal enlargement, which latter has a length twice its diameter; ventral plate long, deeply and roundly emarginate. Female 3.25 mm. long. Abdomen reddish brown. Antennal segments 18, the fifth with a length two and one half times its diameter, the fourth palpal segment a little longer than the third. Type Cecid. a1822.

Rhabdophaga hirticornis n. sp. was reared in September, 1908, and April, 1909, from jars containing *Caryomyia persicoides* galls and those of *Schizomyia pomum*, the Rhabdophaga probably coming from the debris. Male 2 mm. long. Abdomen dark brown. Antennal segments 18, the fifth with a stem three fourths the length of the basal enlargement, the ventral plate broad, deeply and roundly emarginate. Female 2.25 mm. long. Antennal segments 19, the fifth with a length one half greater than its diameter, the fourth palpal segment longer than the third. Type Cecid a1941.

Sackenomyia viburnifolia n. sp. was reared in numbers the latter part of April, 1909, from purplish fusiform vein swellings 5 mm. long, on arrow-wood, *Viburnum dentatum*, taken at Magnolia, Mass., by Miss Cora H. Clarke. Male 1 mm. long; body nearly uniform pale yellow. Antennæ with 14 segments, the fifth with a stem as long as the cylindric basal enlargement. Female 1.5 mm. long. Antennæ with 13 or 14 segments, the fifth with a length one half greater than its diameter. Type Cecid. a1896.

Sackenomyia packardi n. sp. was reared April 15 and 16, 1909, from irregularly swollen twigs of willow taken by Winthrop Packard at

Canton, Mass. Male 2.75 mm. long. Abdomen dark red. Antennæ with 22 segments, the fifth with a stem one fourth the length of the cylindric basal enlargement. Female 3.5 mm. long. Abdomen mostly deep red, 21 subsessile segments. The deep orange larva is unique, with the breastbone dilated anteriorly and multidentate. This species is closely related to *Sackenomyia* (*Cecidomyia*) *porteræ* Ckll., though readily separated therefrom. Type Cecid. a1934.

Rhopalomyia castaneæ n. sp. was reared June 13, 1908, from a gall on chestnut, the leaf petiole being affected and frequently embracing the entire tip of the twig and causing a deformity like brussels sprouts. This gall was taken by the writer at Stowe, Mass. Female 1.75 mm. long. Abdomen a deep fuscous orange. Antennæ with 12 segments, the fifth with a length one fourth greater than its diameter. Type Cecid. a1716.

Cincticornia pustulata n. sp. was reared in April and May, 1909, from oval, pustulate swellings, 5 to 6 mm. in diameter, on the leaves of yellow barked or black oak, *Quercus velutina,* taken by Miss Cora H. Clarke at Magnolia, Mass. Male 2 mm. long. Abdomen deep reddish orange; scutellum fuscous yellowish; wings small and relatively long and narrow; fifth antennal segment with 8 to 9 circumfili. Female, abdomen mostly dark reddish orange, the fifth antennal segment with a length four times its diameter and with four anastomosing circumfili. Type Cecid. a1789.

Cincticornia simpla n. sp. was reared in April and May, 1909, from an irregularly oval, pustulate swelling, 5 to 6 mm. in diameter, from the leaves of the yellow barked or black oak, *Quercus velutina,* and also red oak, *Q. rubra,* taken by Miss Cora H. Clarke at Magnolia, Mass., and also collected in the vicinity of Albany. Male 2 mm. long. Abdomen dark brown; scutellum reddish brown; wings small, relatively short and broad; fifth antennal segment with a length two and one half times its diameter and but two stout circumfili. Female, abdomen mostly deep reddish orange, the fifth antennal segment with a length three and one half times its diameter. Type Cecid. a1942.

Cincticornia globosa n. sp. was reared in April and May, 1909, from a subhemispheric, brown, slightly nippled oak leaf gall, 1.75 mm. in diameter. Male 2 mm. long. Abdomen dark brown; scutellum reddish brown; wings small, relatively short and broad; fifth antennal segment with a length about three times its diameter and 11 circumfili. Female abdomen reddish orange, the fifth antennal segment with a length four times its diameter and 4 anastomosing circumfili. Type Cecid. a1902.

Cincticornia podagræ n. sp. was reared in April, 1908, from a nar-

row, dark purplish, fusiform vein swelling, 8 mm. long, on the under side of oak leaves. Male 2 mm. long. Abdomen a variable reddish or dark brown; scutellum dark brown; wings small, relatively short and broad; fifth antennal segment with a length nearly four times its diameter and 7 or 8 circumfili. Female 2.5 mm. long. Abdomen mostly dark brown, the fifth antennal segment with a length four times its diameter and four anastomosing circumfili. Type Cecid. a1788.

Caryomyia[1] *antennata* n. sp. was reared in the spring of 1909 from a yellowish green or brown, subglobular, thick-walled hickory leaf gall, 4 to 5 mm. in diameter. Male 3 mm. long. Abdomen deep reddish orange, the fifth antennal segment binodose, the nodes separated by distinct stems; dorsal plate broad, narrowly emarginate, the lobes rounded. Female 4 mm. long, the fifth antennal segment with a length three and one half times its diameter, the larval breastbone unidentate. Type Cecid. a1944.

Caryomyia consobrina n. sp. was reared in April and May, 1909, from a small, depressed, globular, yellowish green or brownish, thin-walled hickory leaf gall 2 mm. in diameter. Male 2 mm. long. Abdomen fuscous yellowish; fifth antennal segment binodose, the nodes separated by distinct stems; ventral plate broadly and roundly emarginate. Female 3 mm. long. Abdomen brownish orange, the fifth antennal segment with a length three and one half times its diameter, larval breastbone unidentate. Type Cecid. a1948.

Caryomyia similis n. sp. was reared the latter part of April and early in May from a thin-walled, subglobular, slightly nippled hickory leaf gall 2 to 3 mm. in diameter. Male 1.75 mm. long. Abdomen reddish orange; wings short and broad; fifth antennal segment cylindric, with a length twice its diameter. Female 2.75 mm. long, the fifth antennal segment with a length three and one half times its diameter, the larval breastbone unidentate. Type Cecid. a1946.

Caryomyia inanis n. sp. was reared April 29, 1909, from an irregular, subglobular, thin-walled hickory leaf gall, 2 to 3 mm. in diameter, and easily recognized by the more or less complete false chamber at the tip of the gall. Female 3 mm. long. Abdomen deep

[1]Caryomyia n. g. This genus is allied to Hormomyia, but differs therefrom by the thorax not being greatly produced over the head. There are never more than 14 antennal segments. The flagellate antennal segments of the male are invariably ornamented with three low, stout circumfili and may be binodose. Those of the female are cylindric and provided with but two circumfili. The wings are relatively broad, the third vein uniting with the margin at or near the apex. Type *Cecidomyia tubicola* O. S. There is but one generation annually, the adults issuing direct from the galls.

yellow; wings relatively large and broad; fifth antennal segment with stem length two and one half times its diameter. Type Cecid. a1950.

Caryomia caryæ O. S., *C. holotricha* O. S., *C. sanguinolenta* O. S., and *C. tubicola* O. S., all formerly referred to Cecidomyia and later to Hormomyia, have also been reared and described.

Clinodiplosis caryæ Felt was first taken on hickory June 19, 1906, and subsequently reared from a hickory leaf gall by the late Dr. M. T. Thompson of Worcester, Mass., and last spring was obtained in this office from two different hickory leaf galls. This species is probably an inquiline in hickory galls produced by several species of Caryomyia.

Clinodiplosis spiræ n. sp. was reared in July and August, 1909, from a variable yellowish or reddish marginal roll on young leaves of *Spiræa salicifolia* taken by Miss Cora H. Clarke at Magnolia, Mass. Male 1 mm. long; abdomen yellowish, with its extremities deep orange; ventral plate long, narrowly rounded; fifth antennal segment with the stems respectively two and two and one half times their diameter. Type Cecid. a1838.

NOTES ON ADDITIONAL INSECTS ON CULTIVATED PECANS

By GLENN W. HERRICK, and R. W. HARNED

The senior author has been working for a number of years on insects affecting pecans, and since the publication of Bulletin 96 on Insects Injurious to Pecans by the Mississippi Experiment Station, the following insects have been noted as occurring on pecan trees and causing more or less injury.

Acordulecera maura MacG.

We have found numbers of these sawfly larvæ on the leaves of pecan trees at Agricultural College, Mississippi. They have a curious and interesting method of feeding. They are gregarious and feed on the leaflets in ranks or rows along the margins, with their bodies at right angles to the edges of the leaflets and their heads all pointing outward. They line up along the edge of a leaf in this position, quite as regular as a line of soldiers. They do not invariably assume this regular position in feeding and are sometimes found feeding irregularly over the leaves.

Fortunately these larvæ did not occur in sufficient numbers to produce serious injury, but it is quite possible they may do so. So far as we know, these sawflies constitute a new pest to pecan trees, al-

though Doctor Chittenden writes that he found some sawfly larvæ working on pecan trees in Maryland, but does not say what species they were.

In our attempt to breed these larvæ we hurriedly placed them on leaves, the stems of which were kept in a tumbler of water, the whole being placed on a table under a glass cylinder without any earth. They, therefore, had no opportunity to enter the earth to pupate, had they so desired.

They spun their cocoons at the bases of the leaves among the cotton and among the debris that had accumulated on the table, and a few spun cocoons here and there among the leaves.

We were both absent from the college for a day at this time and found on our return that all the cocoons had been spun in our absence, May 6.

On May 11 adults appeared, which we sent to Doctor McGillivray for identification. In a letter of June 8 he informed us that they belonged to the species *Acordulecera maura* MacG., which he had just described in the Can. Ent., Vol. XL, May, 1908, p. 168. He there records this species from North Mt., Penn., Ames, Iowa, and Ithaca, New York.

From our observations on this insect, we conclude that it might become of some economic importance if it ever happened to occur abundantly. We believe, however, it could be easily controlled by the use of arsenate of lead.

Sawfly No. 2

During the month of April, 1908, we found many rather large sawfly larvæ on the leaves of pecan trees. These also have a very interesting method of feeding and quite distinctive from the foregoing species. The larvæ feed separately and, for the most part, begin at the top of a leaflet and eat it clean on both sides of the midrib as far as they go. Whenever one of them desists from eating and assumes a resting attitude, it always curls or coils tightly about the naked midrib (or petioles), to which it tenaciously clings. Occasionally one begins in the middle of a leaflet and eats out a hole on both sides of the midrib, always, however, lying closely curled about the midvein when at rest. This attitude seems characteristic, although I am not widely familiar with sawfly larvæ and their habits. Although we observed these larvæ carefully during their life history and made descriptions of the different stages and molts, yet we make no record of them here because we believe there were two species among the larvæ

observed and some confusion exists in our minds regarding the differentiation of the two.

They pupated during June.

Aulacaspis pentagona Targ.

We are not aware that this coccid has ever been recorded as occurring on the pecan. We found it in considerable numbers on the branches of pecan in Natchez, Mississippi, in the yard of a gentleman where this insect was quite abundant on peach trees. It was associated with the next species.

Chrysomphalus obscurus Comst.

We also found this species occurring in great abundance on the branches of pecans growing in the same yard. This coccid has been reported on hickory, but we can find no record of it on pecan.

Phylloxera caryaecaulis Fitch.

We have had reports and specimens of this pest on pecans from several correspondents in Mississippi. On May 22, 1908, we received from a correspondent some pecan branches which were literally covered with the galls of the insect. Mr. Sherard, the correspondent, said "they covered every twig on the tree like the sample sent. I noticed them on others in the same vicinity. Can you tell me whether or not there is any danger of their killing or injuring my trees? They seem to be retarding this year's growth."

The petioles and young twigs sent to me were covered with galls, large and small. The galls opened by several valves, usually four, like a Geaster puff ball. The specimens were submited for identification to Doctor Pergande, through the kindness of Dr. L. O. Howard.

Mr. Pergande gives a description of this insect and its stages in his monograph of the North American Phylloxerinæ, p. 244. We hope to get opportunity to study all of these species farther and in more detail, together with other pecan pests of which we have only fragmentary notes at present.

Aspidiotus perniciosus Comst.

We found this notorious pest occurring quite abundantly on pecan trees at Scranton and Stinson, Miss. It was mainly confined to the petioles of the leaves but was also present on the bark.

All the affected trees were near badly infested orchards of plum and peach trees.

A PRELIMINARY LIST OF THE COCCIDAE OF WISCONSIN

By HARRY C. SEVERIN and HENRY H. P. SEVERIN, *941 Grove St., Milwaukee, Wis.*

Very little has been done on the Coccidæ of Wisconsin, and, with the exception of the nursery and orchard inspector's reports, scarcely any references are to be found in literature on this important economic group of insects occurring in this state. The following list of scale insects is not intended as a complete enumeration of the Coccidæ to be found in Wisconsin, but is presented simply as a preliminary to the study of this fauna. All of the species listed were, with one exception, collected by the writers during the year 1908 in Milwaukee County. We have omitted the Eulecaniums in this paper, preferring to delay the publication of the species belonging to this genus, which we have collected, until Mr. J. G. Sanders, who is revising the genus, may have completed his work.

It is the plan of the writers to publish later an illustrated manual with keys and descriptions for the species to be found in Wisconsin. It is hoped that this paper may interest collectors in various parts of the state, without whose assistance this work can progress but slowly. Any assistance in the way of specimens occurring in the state will be thankfully received and proper credit will be given to the collectors.

Little trouble need be experienced in collecting or preparing scale insects to be sent through the mails. As a rule the out-of-door Coccidæ are to be found chiefly on the smaller twigs and branches of shrubs and trees in this region; yet some may be found on the leaves of trees, as on the evergreens, on the roots of plants or in the nests of ants. The indoor scale insects, or the scale insects which infest our conservatories, have been introduced into this state from warmer climates and may be found not only on all parts of trees and shrubs but upon herbaceous plants as well. As a general rule it is best to gather portions of an infested plant with the insects *in situ* and to preserve these in the dry condition. At times, however, as with the softer species of Coccids, alcoholic material is often useful, but even in such instances it should always be supplemented with dry specimens. It cannot be too strongly urged that when possible, plenty of material should always be taken. For, while the better known species can usually be recognized from an examination of the superficial characters of a few specimens or even of a single scale, less known species or new species require quite a number of specimens,

s that they may be properly studied. Small card boxes, or if these are not to be had, large envelopes are generally used to send scale insects through the mails. With the insects there should always be enclosed, when possible, the following information: locality in which the insects were collected, date of collection, name of food plant, name of collector, extent of injury to the plant, and any other remarks that may seem desirable.

We are indebted to Dr. C. L. Marlatt for verifications of species and to Prof. Herbert Osborn for literature used from his excellent library on Coccidæ.

1. *Kermes andrei* King, on oak, July 29, 1908.
2. *Kermes pubescens* Bogue, on oak, July 29, 1908.
3. **Pseudococcus citri* (Risso), common in greenhouses.
4. **Pseudococcus longispinus* (Targ.), common in greenhouses.
5. *Pulvinaria vitis* (Linn.), common and often injuriously abundant on maples; also on grape, linden, lilac and willow.
6. **Eucalymnatus perforatus* (Newst.), on palm and seaside grape.
7. **Coccus hesperidum* (Linn.), on banana and century plant.
8. **Coccus longulus* (Dougl.), on Acacia, Ficus lanceolata and mimosa.
9. **Saissetia hemisphærica* (Targ.), on croton, ferns, oleander and many other greenhouse plants.
10. **Saissetia oleæ* (Bern.) on oleander and fig.
11. *Chionaspis americana* Johns., on Ulmus americana, August 11, 1908.
12. *Chionaspis corni* Cooley, on Cornus, August 11, 1908.
13. *Chionaspis furfura* (Fitch), on apple, hawthorn and pear, August 12, 1908.
14. *Chionaspis lintneri* Comst., on Corylus, August 17, 1908.
15. *Chionaspis pinifoliæ* (Fitch), on Pinus sylvestris, August 5, 1908.
16. *Chionaspis salicis-nigræ* (Walsh), on Populus tremuloides, sent to us by Prof. Wm. S. Marshall from Madison, Dane County, December 29, 1908.
17. **Diaspis boisduvalii* Sign., on cycads, palms and various other greenhouse plants.
18. **Diaspis echinocacti cacti* Comst., on cactus.
19. *Aulacaspis rosæ* (Bouché), on raspberry and rose, August 28, 1908.
20. **Aulacaspis zamiæ* (Morg.), on Cycas revoluta.
21. **Hemichionaspis aspidistræ* (Sign.), on Cycas revoluta, ferns and other greenhouse plants.
22. *Aspidiotus æsculi* Johns., on bur oak, linden and pear, July 24, 1908.
23. *Aspidiotus ancylus* (Putn.), on oak, July 25, 1908.
24. *Aspidiotus forbesi* Johns., on hawthorn, July 24, 1908.
25. **Aspidiotus hederæ* (Vall.), on Acacia, Asparagus, Cycas revoluta, oleanders, palms, Yucca, etc. Also sent to us by Prof. Wm. S. Marshall from Madison, Dane County.
26. *Aspidiotus juglans-regiæ* Comst., on linden and maple, July 30, 1908.
27. *Aspidiotus ostreæformis* Curt., on linden and plum, July 30, 1908.

*The greenhouse species are indicated by an asterisk (*).

28. *Aspidiotus perniciosus* Comst., injuriously abundant on Cornus, rose and willow, Forest Home Cemetery, Milwaukee, August 18, 1908.
29. *Aspidiotus ulmi* Johns., on elm, July 21, 1908.
30. [1]*Aspidiotus*, cross between *juglans-regiæ* Comst. and *ostreæformis* Curt., injuriously abundant on trembling aspen and willow, July 9, 1908.
31. **Chrysomphalus aonidum* (Linn.), on oleander, orange and palms.
32. **Chrysomphalus aurantii* (Mask.), found on oranges in the Milwaukee markets.
33. **Chrysomphalus dictyospermi* (Morg.), on Cycas and palms.
34. *Chrysomphalus obscurus* (Comst.), on oak, July 29, 1908.
35. **Chrysomphalus persew* (Comst.), found on holly in the Milwaukee markets.
36. **Lepidosaphes beckii* (Newm.), found on lemons and oranges in the Milwaukee markets.
37. *Lepidosaphes ulmi* (Linn.), injuriously abundant on apple, pear and willow; also found on Cornus, currant, hawthorn and linden, July 8, 1908.
38. **Ischnaspis longirostris* (Sign.), on palms.

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[1]Specimens of this scale were sent to Dr. C. L. Marlatt with a note calling to his attention the fact that while the insect which we were sending him resembled to some extent *Aspidiotus ostreæformis* Curt. and *Aspidiotus juglans-regiæ* Comst., it was radically different from either in many characters. The following is offered as an explanation for the resemblance which this insect bears to the two above-mentioned species of Aspidiotus by Marlatt and is quoted verbatim from a letter received from him:

"In my manuscript revision of the genus Aspidiotus I have designated this form as a cross between *juglans-regiæ* Comst. and *ostreæformis* Curt. The former is the American representative of *ostreæformis*, and has developed into a fairly distinct species, differing in notable structural features from its European ally. These crosses have appeared in situations where both species occur, and the reproduction of certain of the structural features of each is such as to make the evidence of crossing very complete and confirms the belief in the not very remote separation of the two species named from a common ancestor. This form, which I believe to be cross bred, bears strongest resemblance to *ostreæformis*, but approaches *juglans-regiæ* in size and in the dorsal pores and in the character of the terminal lobes. The chitinous paraphyses or chitinous thickenings at the base of the lobes are practically as in *ostreæformis*. The parageuitals also approach more nearly *juglans-regiæ*."

Entomological Laboratory, Ohio State University.

NOTES ON APHIDIDAE COLLECTED IN THE VICINITY OF STANFORD UNIVERSITY

By W. M. Davidson

This list is but a preliminary one, since the forms have been studied only during the past year. Doubtless there are many other species in the neighborhood which I have not collected. A few new species have been described, while certain others, showing affinities to described species but possibly new, have been left unnamed for the present. Two or three European forms not heretofore listed in catalogues from America have been observed, generally on imported plants.

Phylloxera vastatrix Planchon; *Vitis.*

Very abundant in a vineyard on the campus, doing much damage.

Chermes pinicorticis Fitch; *Pinus pinaster maritima.*

On the needles during the fall months.

C. cowani Gillett; *Pseudotsuga douglasii.*

In large numbers on a young Douglas spruce.

Pemphigus betæ Doane; *Rumex occidentalis* (roots).

P. populicaulis Fitch; *Populus tricocarpa.*

Common on poplars in the fall, and in March when the stem-mothers were founding their colonies.

Colopha ulmicola Fitch; Elm.

Schizoneura lanigera Haus.; Apple.

Very common in apple orchards on the campus.

Lachnus viminalis Fonsc.; *Salix.*

Found in November on the bark of willow. A parasite, *Aphidius* sp., was reared in considerable numbers.

L. abietis Fitch; *Abies concolor.*

In large colonies in the fall on the limbs. No winged forms were seen.

L. pini-radiatæ sp. nov.; *Pinus radiatæ.*

Alate Female

Length of body 2.2 mm.; breadth of body .75 mm.; expanse of wings 7.2 mm.; antennal joints III .48 mm.; IV .28 mm. V .28 mm.; VI .23 mm. Very similar to the apterous female. Cornicles dusky, truncate, very short; cauda green, short, conical; antennæ very pilose, yellow, darker at the articulations of the joints; wings large; stigma greyish brown, long, narrow; basal half of

third discoidal almost obsolete, the two branches running parallel, but being very faint at their point of junction; veins brown, slender, except the second discoidal, which is robust; beak reaches second coxæ. Found on the needles of cultivated Monterey pines, both in the greenhouse and outside. The insect covers itself lightly with a gray flocculent coating. This species shows a certain similarity to *L. californicus* Essig, but is larger in all its measurements and has the antennæ larger in comparison to its length and lacks the red spots in the adult stage.

Apterous Female

With grayish pulverulence removed, dark green; length of body 2.40 mm.; breadth of body .95 mm.; length of beak .55 mm.; antennæ III .50 mm.; IV .25 mm.; V .25 mm.; VI .20 mm.; long, narrow towards the extremities; head dusky; eyes red; antennæ pale, half as long as body, hairy; the last joint and the articulations dusky; thorax and abdomen dark green; cornicles very short, truncate, dusky; cauda green, conical; legs long, especially the posterior pair, dark green; the femora and tibiæ are hairy; tarsi black; beak dusky, barely exceeding the third coxæ.

The young are wholly pale green, except the eyes and abdominal spots, which are pink. The last joint of the antennæ and tarsi are dusky.

Lachnus occidentalis sp. nov.; *Abies grandis.*

Apterous Female

Length of body 2.90 mm.; breadth of body 1.50 mm.; beak .90 mm.; antennæ III .35 mm.; IV .12 mm.; V .20 mm.; VI 18 mm.; dark green or brown; eyes red; antennæ one third as long as body, yellow, sixth joint dusky; head darker than abdomen, short; prothorax dark, with the suture yellow; legs yellow, hairy, the articulations and tip of tarsi black; abdomen broadly oval; cornicles lateral, conical, dusky at the tip; cauda very short, blunt; beak dusky, almost half as long as the body. The young are brown. This species lives in large colonies along the underside of the young shoots of *Abies grandis*. Their presence can be detected by a smoke-colored, flocculent matter, and by the blackening of the leaves from the association of a fungus with their excretions. Ants are always to be found among them, and they are preyed on extensively by a Syrphus fly. This louse occurs on *Abies grandis* in the fall and spring. Winged forms were not seen.

L. alnifoliæ Fitch; *Alnus.*

This large, green, rapidly moving species was taken on the alder in April.

Cladobius salicti Harris; *Salix.*

Taken on willow in November, both sexes.

C. rufulus, sp nov.; *Salix* sp.

Alate Female

Length of body 3.8 mm.; expanse of wings 11.25 mm.; antennæ III .60 mm., IV, .40 mm., V .40 mm., VI .25 mm., VII .27 mm.; head, prothorax and thoracic lobes grayish-black; prothoracic tubercles small, blunt; eyes dark;

antennæ two thirds as long as body, black, hairy, the base of third joint pale; legs black and pilose; basal part of femora green; tibiæ brown, with black apices; abdomen elongate oval, dusky orange, with seven transverse black bars on the dorsum. These bars are sometimes broken in the center and do not reach the lateral margins. There are on the abdomen lateral rows of black spots. Cauda short, pilose, orange, tipped with black; cornicles half as long again as the cauda, pale orange, with dusky tips, contracted for their basal third and again, slightly, at their tips; wings long, narrow; stigma gray, narrow, acutely pointed at the apex; subcosta and insertions dark; veins brown, third discoidal obsolete at its base; origin of second branch near the apex of the wing; beak just reaches posterior coxæ.

Apterous Viviparous Female

Length of body 3.3 mm.; breadth of body 1.5 mm. cornicles .4 mm.; dark green or in some specimens brownish; antennæ pilose, half as long as body, pale yellow, with joints dusky; eyes red; legs brownish yellow, tibial apices and tarsi black; cornicles yellow, slightly clavate, black at their tips; beak reaches first abdominal segment. The body is covered all over with short hairs. Found on the stems and leaves of Salix in April. This species is much attended by ants. A large parasite (*Dieretus*) was bred from infested specimens.

Chaitophorus sp. *Salix.*

A small black species found on the leaves and twigs of willow in April. Alate forms were not found. Length of body 1.80 mm.; breadth of body .9 mm.; head, thorax and abdomen black, with the exception of a median yellow line, which varies in width; body broadest near the posterior end; legs and antennæ grayish; antennæ thick, pilose, almost half the length of the body; III .3 mm., IV .17 mm., V .09 mm., VI .07 mm., VII .1 mm.; cornicles short, tuberculate, broader than long, pale; cauda short, pilose, black; beak exceeding second coxæ; pupa like larva; thorax and wing-pads green. In alcoholic specimens there appear light patches at the base of the cornicles and transverse rows of dots on the abdominal segments. Not having any alate forms, I will not venture to give this species a name, as it has possibly already been described.

Callipterus betulæcolens Fitch; *Betula.*

On the under side of leaves of birches in Palo Alto in May.

C. caryæ Monell; English Walnut.

This little species is very common on walnut trees on the University Campus. I found them in large numbers on the buds and unfolding leaves in March.

C. arundicolens Clarke; Bamboo.

Found sparingly on the under side of the leaves of the bamboo (*Arundo*) in October.

C. ulmifolii Monell; *Ulmus.*

Found in large quantities on the leaves of the elm (*Ulmus*) in the

fall months. A large percentage of the individuals are pinkish. This insect was scarce in the spring.

C. quercus (?) Kalt; *Quercus.*

On both the white oak (*Q. lobata*) and the blue oak (*Q. kelloggii*) I took a species of *Callipterus* having six tubercles on the dorsum. The species is green and is very similar to the *C. quercus* as described in Buckton's Monograph of British Aphides. This insect infests the under sides of the leaves in large companies. It was very common in April and May, though scarce in the fall.

C. tiliæ Linn.; *Tilia.*

This European species was found sparingly on the leaves of linden trees.

Aphis brassicæ Linn.; Mustard.

Very common on the mustard (*Brassica campestris*), where it was abundantly parasitized by an *Aphidius.*

A. rumicis Linn.;

Common on ivy shoots in March; also taken on the vetch (*Vicia*) and *Senecio mikanioides.*

A. ceanothi Clarke; *Ceanothus cuneatus.*

This brown species was found in immense colonies on the tips of the shoots of the mountain lilac (*C. cuneatus*).

A. medicaginis Koch; *Medicago denticulata.*

Found on the bur-clover in April. A Braconid (*Lysiphlebus* sp.) was reared from parasitized specimens.

A. pomi (?) De Geer; Pear.

A dark green species agreeing with *A. pomi,* with the exception that cauda was black and the body dark olive green. Taken in large colonies on pear in May.

Aphis sp.; *Senecio mikanioides.*

Alate Female

Length of body 1.30 mm.; expanse of wings 5.2 mm.; antennæ joints III .3 mm., IV .22 mm., V .12 mm., VI .08 mm., VII .14 mm.; general color dark green; head and thoracic lobes black; eyes dark red; antennæ two thirds length of body, dark green; joints 3 and 4 strongly tuberculate, joints 3, 4 and 5 with small sensoria; abdomen green, paler below; on the dorsum posterior to the cornicles, there are two cross-bands of dark green; cornicles short, barely exceeding the tarsi, slightly tapering to their apices, almost black; cauda short, green, pilose, globular; legs yellowish green, the joints darker, the tarsi green; veins and stigma brownish grey; insertions pale; veins thin, the discoidals obsolete at their bases; beak pale, reaching the abdomen.

The Apterous female is paler, with the thorax and head yellowish-green. The cornicles are short and pale; legs pale yellow, tarsi dusky; abdomen pale green; antennæ green, one third as long as the body. There is also a rufus form of the apterous viviparous female. Found during the year on *Senecio balsamioides*. It infests the younger shoots and leaves.

Aphis sp.;

A small doubtful species found on both Groundsel (*Senecio*) and *Amsinckia*. The apterous females are green throughout. The alate form has short black cornicles, black bars and spots on the dorsum of the abdomen and the head and thorax black.

Rhopalosiphum dianthi Schrank; *Sonchus.*

Taken in the fall on *Sonchus oleracea*, also on the celestial pepper in a greenhouse. I bred from this insect a very minute wingless dipterous parasite.

R. violæ Pergande; *Viola.*

Found on the cultivated blue violet in May. This form seemed to serve as a link between Pergande's species and that of Essig (Pomona Journal of Entomology No. 1), having the characteristics of both, which appear to me like identical species, despite slight differences in descriptions.

Rhopalosiphum sp.; Almond.

On the stems of a young almond in May I found an aphid (apparently a *Rhapolosiphum*). This is a large red species.

Hyalopterus arundinis Faber; Plum.

In large quantities on the plum in May.

Myzus achyrantes Monell; *Malva parviflora.*

Found commonly on mallow (*M. parviflora*). I bred a small *Aphidius* from this species.

M. persicæ Sulz.; Peach.

On the peach and plum trees in May.

Drepanosiphum acerifolii Thos.; *Acer saccharinum.*

This beautiful species inhabits the leaves of the soft maple (*A. saccharinum*). The winged forms are very active and possess considerable jumping powers.

Siphocoryne salicis Monell; *Salix.*

Found in both the apterous and alate forms under the leaves of willow in April.

S. xylostei Schrank; *Lonicera.*

This European species infests the tips of branches of the honey-

suckle (*Lonicera*) and crowds the leaves in very great numbers, causing them to assume a very unsightly appearance.

Siphocoryne conii sp. nov.; *Conium maculatum*.

On the flower-stalks and leaves of the hemlock.

Alate Female

Head, thorax, cornicles, cauda, tarsi and apices of the tibiæ black; antennæ yellowish-green, a little over half the length of the body; joints 3–6 with sensoria; legs yellow; abdomen bright green; wings penciled over with dots; stigma and veins pale brown; cornicles black, not very incrassate, slightly exceeding the tarsi in length; cauda black, pilose, three fourths the length of the cornicles.

Apterous Viviparous Female

Green; body oval, broadest just behind the middle; antennæ yellow, one third the length of body; joint 3 equals the three following joints in length; eyes very dark red and small; legs yellow; femora and apices of tibiæ black; tarsi yellow; cornicles black, considerably more incrassate than in the winged form, reaching to tip of abdomen; cauda paler, four fifths the cornicles; beak short, not reaching second coxæ.

Length of body (alate) 1.2 mm.; (apterous) 2.75 mm. Length of cornicles (alate) .12 mm.; (apterous) .2 mm. Length of cauda (alate) .09 mm.; (apterous) .16 mm. Breadth of body (apterous) 1.15 mm.; wing expanse 4.6 mm.; antennal joints (alate) III .2 mm., IV .12 mm., V .12 mm., VI .20 mm., VII .19 mm.

Parasitized by an *Aphidius*.

Macrosiphum sonchella Monell; *Sonchus oleracea*.

M. rosæ Linn.; *Rose*.

M. pisi Kaltenbach; *Urtica holosericæ* and *Lathyrus*.

M. californica Clarke; *Salix*.

Abundant on tips of willows in April.

M. sp.; *Lupinus* sp.

M. orthocarpus sp. nov.; *Orthocarpus* (owl clover).

Alate Female

Pea green; eyes pink; joints 3–7 of antennæ, tip of beak, distal two thirds of cornicles, tarsi, apices of femora and tibiæ black; thoracic lobes orange brown; lower side of thorax brown; antennæ slightly longer than the body; joint I is gray, three times as large as II, which is paler; joint III is longest; femora very pale (except the apex); tibiæ brown; abdomen, head, prothorax, base of cornicles, and cauda bright pea green; cornicles not quite reaching tip of cauda, cylindrical, .7 mm. in length; cauda, pointed, pilose, .35 mm. in length; wings long and narrow; stigma pale brown; insertions and subcosta green; veins deep brown; beak not quite reaching second coxæ; length of body 3 mm.; expanse of wings 8.5 mm.; breadth of body .95 mm.; antennal joints, III .85 mm., IV .6 mm., V .5 mm., VI .12 mm., VII .8 mm.

Apterous Viviparous Female

Bright pea green, larger than the alate form; antennæ and distal two thirds of cornicles black; body more than half as broad as long (excluding cauda); eyes red; antennæ reaching just beyond tip of cauda, black, except joints I, II and base of III very similar to that of the winged female; legs pale green; apices of tibiæ and tarsi dark brown; cornicles not quite reaching tip of cauda; cauda green, tapering, about one half the length of cornicles; beak short, barely reaching second coxæ, the tip black.

The young are very pale, with large red eyes and the distal antennal joint dusky. Found sparingly among the flower spikes of *Orthocarpus purpurascens* in April.

Scientific Notes

Stable Fly. In the Bulletin de la Société Nationale d'Acclimatation de France, March, 1909, Lucien Iches has published a very interesting article on *Stomoxys calcitrans* and Argentine cattle, giving the results of a brief investigation made by him last year in the province of Santa Fé, Argentina. *Stomoxys calcitrans* swarmed on a large estate in almost incredible numbers. The cattle were nearly driven crazy by them. Certain valuable Durham bulls which were observed were covered with flies, had lost their hair in large spots, and the skin was cracking. Monsieur Iches naturally sought at once for the principal breeding places of the flies, and found them to be in the stacks of debris from the threshing of wheat and flax. Larvæ and puparia were found by the millions in the lower portions of these piles of straw, where some fermentation had already begun. The sensible measure which he recommended was to have this debris burned within forty-eight hours after the completion of the threshing, the ashes being used for fertilizing purposes. It seems that there exists in the province of Santa Fé an old provincial law ordering the burning of the debris after threshing, but that it has not been enforced of late years. L. O. H.

Insects on Imported Nursery Stock. The discovery of the nests of the brown-tail moth on foreign importations of seedlings into the State of New York has prompted a very close inspection of nursery plantations this summer for caterpillars of this species, which might possibly have escaped treatment at the time of the planting of the stock in the nurseries. With this close supervision of nurseries, there have been found on foreign seedlings eggs of the Rusty Tussock Moth (*Notolophus antiqua* Linn.) and several colonies of the larvæ of the Little Ermine Moth (*Hyponomeuta padella* Linn.) which were feeding on cherries. These were collected and brought into our laboratory for identification by Messrs. Fred Wiley and John Maney respectively, who are official nursery inspectors.

According to Judeich and Nitsche, *H. padella* thrives on the service tree, wild plum, hawthorn, medlar and on various species of Pyrus. Theobald says that in England this species feeds normally on hawthorn, often quite defoliating hedgerows, and also attacks cherry and plum. In France it is said to subsist on cherry and plum and in Italy on plum.

P. J. Parrott.

Snow-white Linden Moth. (*Ennomos subsignarius* Hubn.) The serious injuries to beech and other forest trees of last year were continued this season in New York State by extensive depredations in the vicinity of Cooks Falls, Delaware county, in the town of Denning, Ulster county, and about Dahlia, Sullivan county. The remarkable urban flights of this species recorded last year in widely separated Hudson river and Mohawk valley localities were repeated in New York City and some other Hudson valley localities, at least.

E. P. FELT.

Aphididae or plantlice. The early part of 1909 has been noteworthy because of the remarkable abundance of these insects in New York state upon various trees and shrubs in particular. The outbreak of this season is comparable only with that of 1897 and 1903, years distinguished by the superabundance of plantlice in New York state. Observation and weather records show a correlation between an unusually low temperature and the multiplication of aphids. The present season was remarkably cool and backward, a marked change for the better occurring June 21, accompanied by the rapid development of natural enemies, such as lady beetles and Syrphidæ or flower flies in particular. These latter became so numerous as to practically wipe out the hordes of plantlice by the end of the first week in July. Climatic conditions similar to those described above prevailed in New York state during the outbreaks of six and twelve years ago. It is interesting, in this connection, to note that recent observations on the spring grain aphis in the southern and middle states by agents of the Bureau of Entomology have shown a correlation between temperature and the development of plantlice and their enemies. Experiments with this species demonstrated the futility of large importations of parasites in the expectation of hastening its control. The writer should not be understood as taking the position that unseasonably low temperatures are invariably accompanied by plantlice outbreaks, though there is no doubt but that such conditions have an important influence upon the development of these pests.

The following species were unusually abundant or destructive. The green apple aphis, *Aphis pomi* DeG., and probably its associated species, was excessively abundant and injurious in the important fruit sections of the state. A plum aphid referred by Mr. Pergande to the genus Siphocoryne was very numerous. The common cherry aphis, *Myzus cerasi* Linn., destroyed most of the tender leaves, on young trees in particular. Hard maples, especially the Norway maple, in widely separated parts of the state, were very badly infested by *Chaitophorus accris* Linn. A very large amount of honeydew was produced, and in not a few instances ten to twenty-five per cent. of the leaves dropped, the latter due in large measure to plantlice infestation. The inconspicuous *Callipterus ulmifolii* Mon. was unusually abundant on elms at Dunkirk and Fulton, N. Y., considerable annoyance being occasioned by the large amounts of honeydew, not to mention the injury to the trees. The woolly elm leaf aphid, *Schizoneura americana* Riley, was also excessively numerous in some localities. The cockscomb elm gall, *Colopha ulmicola* Fitch, was unusually abundant, occasional trees having most of the foliage seriously deformed. The beautiful *Drepanosiphum acerifolii* Thos. was very abundant and rather injurious to soft maples in particular. Weeping birch at Albany and Hudson, N. Y., was very badly infested by *Hamamelistes spinosus* Schim-

a species with a remarkable life cycle and better known on account of the peculiar spiny bud gall it produces on witch-hazel. *Callipterus betulaecolens* Mon. was abundant on certain birches. Ornamental, particularly purple beeches, were badly affected by the woolly beech leaf aphid, *Phyllaphis fagi* Linn. One small tree noted had its foliage nearly destroyed by this species. The pine bark aphid, *Chermes pinicorticis* Fitch continues abundant in the vicinity of Albany, and is probably responsible in large measure for the gradual destruction of two groups of young pines in Washington Park, Albany, N. Y. The woolly larch aphis, *Chermes strobilobius* Kalt., was numerous, though not excessively abundant. The work of the spruce gall louse, *Chermes abietis* Linn., is very evident in some localities, and in Washington Park the peculiar destruction of the buds without the production of the characteristic galls continues and appears to finally result in the death of branches, or even the entire top of a tree.

E. P. Felt.

Brown-Tail Moth (*Euproctis chrysorrhœa* Linn.). A small infestation was discovered late in June in the town of Rye, near the village of Port Chester, and only about a thousand feet or so from the Connecticut state line. Only sixteen caterpillars or thereabouts were discovered after repeated inspections. The infested area and its vicinity has been thoroughly burned over several times with a cyclone burner and, in addition, the few trees and shrubs in the vicinity have been repeatedly sprayed with a contact insecticide. Trap lanterns have also been operated and a close watch is being kept for the appearance of moths. No expense is being spared in an attempt to exterminate this infestation.

E. P. Felt.

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

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The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, so far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Reprints of contributions may be obtained at cost. Minor line figures will be reproduced without charge, but the engraving of larger illustrations must be borne by contributors or the electrotypes supplied. The receipt of all papers will be acknowledged.—Eds.

The peculiar meteorological and entomological conditions obtaining in New York State the present season indicate the desirability of more exact and generally applicable information respecting the influence of climate upon the development and abundance of various insects. It is well known that variations in temperature and moisture have a profound influence upon the development of certain species, and it is more than probable that the relative intensity of light influenced by the presence or absence of clouds is also an important factor. The early part of the season of 1909 was remarkable for its coolness, accompanied by a retardation in the development of vegetation. The same was true in 1903 and in 1897—all years accompanied by a superabundance of plantlice. Is there a correlation between the two phenomena? Entomologists in other parts of the country must have witnessed similar conditions, most of which, we fear, are allowed to go unrecorded. Knowledge of this kind, if generally applicable, would be invaluable to the economic entomologist, and we would suggest that data along these lines is at least worthy of record and might, under certain conditions, be tested experimentally. There is certainly an inviting field for any one willing to study carefully the connection existing between climate and the development of insects. There are already a number of records showing a most intimate relation between meterological conditions and the growth and multiplication of certain injurious species, while the influence of minimum temperatures has been the subject of careful studies by several observers.

There is another general subject deserving attention at the present time. Recent years have witnessed numerous outbreaks by leaf feeding caterpillars, particularly in forests. New York State, for example, suffered greatly about 1900 from extensive depredations by the forest tent caterpillar. Forests were severely injured in 1906 and 1907 by the green striped maple worm and the snow-white linden

th, the latter continuing its devastations the present season. It is believed that these outbreaks are due in large measure to the scarcity of native insectivorous birds. Can this be substantiated by observations in other parts of the country or proved by experimental data? Are birds more efficient natural checks upon our forest fauna than insect parasites and fungous diseases? Various entomologists must possess unpublished data of much value along these lines and we would like to see it collaborated in order that the evidence may be carefully weighed and we be in a better position to judge as to the relative efficiency of the various factors maintaining a balance between insect and vegetable life.

Reviews

Codling Moth Investigations, by E. D. SANDERSON. 19th and 20th Reports of the New Hampshire College of Agriculture and Mechanic Arts, p. 396–498, 1908.

During the past few years the codling moth has received attention at the hands of numerous investigators, and much has been added to our knowledge of this important apple pest. A recent contribution to the subject is that by Professor Sanderson, comprising somewhat more than one hundred pages, with numerous half-tone illustrations which add materially to the clearness of the text. The article deals primarily with the codling moth in New Hampshire and includes results of observations for the past three years. It is especially timely, since heretofore there has been but little exact information on the seasonal history of the insect in the New England States, representing temperature conditions different from those prevailing in other fruit-growing regions where the species has been carefully studied. A large amount of data is presented and a large series of experiments with remedies are reported upon in detail.

Under the remarks on hibernation is shown the distribution of codling moth larvae on the trees during the hibernation period, and also the winter mortality of larvae under natural orchard conditions—facts not previously determined. An examination of seven apple trees in May, 1907, showed that out of 385 cocoons found, 70 per cent. were located on the trunk, and the remainder on the main branches. Of the larvae on the trunks, 97 were within one foot of the crotch; 112 within one foot of the ground; and 60 were between on the middle portion of the trunk. The mortality records of larvae on the seven trees show that 5 per cent. only were alive at the time of examination; 87 per cent. had been killed by birds; 4 per cent by fungous disease; and 3 per cent. by cold.

Data is presented to show the relation of temperature to the pupal stage, and it is calculated that for spring pupae from 470 to 480 degrees are required above 30 degrees F., practically a thermal constant. It is apparent,

however, that these conclusions are permissible only in a very broad way, and it must be admitted that in the case of this and other insects thermal constants have not been established with any degree of definiteness. Temperature studies of this character, however, are of much possible practical importance, but information is needed on other influencing factors.

The distribution of eggs on the apple trees has been well determined, involving an immense amount of work. In general, it appears that eggs are deposited promiscuously over the foliage, twigs, and fruit, much the majority of the eggs being placed on the leaves and without any reference to the nearness of the fruit.

A distinct advance is made in our knowledge of the feeding habits of the newly hatched larvae, as it is shown by repeated observations that these feed freely upon the foliage, mining into the leaves and boring into the tender shoots. Larvae in breeding cages were reared to maturity on foliage alone, and the author considers that such feeding probably occurs in orchards. This bears directly upon the question of the value of spraying the trees at a time when the larvae are hatching in maximum numbers, as three or four weeks after the petals fall; and also upon the possibility of extermination of the insect during off crop years and in the case of total failures of crop in restricted orchard regions, as has been recently admitted in the Southwest.

Statistics are presented showing the places of entry of apples by larvae. Records from nine orchards show a variation of from 39 to 77 per cent. of first-brood larvae entering at the calyx end on unsprayed trees, with an average of 65 per cent. Of the second brood larvae, from 22 to 29 per cent. were found to enter the fruit at the calyx end, the average being 46 per cent. This is lower than has been reported by other workers, as by Messrs. Simpson, Ball, and Pettit.

The proportion of first-brood larvae which develop to pupae and moths in New Hampshire, is, fortunately for the apple grower, quite small. From the observations and band records of Professor Sanderson, it is shown to be not more than 3 per cent., and he considers that it may not be more than 1 or 2 per cent.

It is to be regretted that a summary was not given showing the length of the life cycle of the codling moth, as based on the average figures for the respective stages. This may not be computed from lack of data on length of pupal stage of the first generation.

Under "Experiments in Spraying for the Codling Moth,' a large amount of detailed data is given, covering the work in several orchards during the years 1906, 1907, and 1908. The plan of work, as outlined on page 416, is comprehensive, and it would have been an advantage had the results been briefly summarized in conformity with the outline.

A schedule of applications of sprays, as based on the work reported, would also have been an advantage, and would doubtless be applicable to the New England states as a whole. Professor Sanderson well points out the desirability in spraying for the codling moth of having plats of sufficient size and of using a sufficient number of trees to avoid possible complication from overflow of moths from one plat to another, and of securing counts from a sufficient number of trees to eliminate as much as possible the individual variations in the percentage of worminess. In the

method of recording and tabulating results, a somewhat complicated though accurate plan is adopted (p. 441).

An attempt to separate the effect of poisoning the calyx cavity only, by the use of an atomizer, and of spraying foliage only (the fruit being covered by paper bags) did not furnish very definite results, attributed by Professor Sanderson to the fact that in spraying with the atomizer for the calyx cavity only, the exterior of the fruits also are poisoned to a greater or less extent.

In the comparison of "Drenching vs. Mist Sprays," it can hardly be claimed, in the writer's opinion, that the conditions for drenching work, as recommended by western entomologists, have been entirely met. Thus, the pressure (a most important factor in the work) in 1907 and in one orchard in 1908 was only from 80 to 100 pounds; and in 1908 from 110 to 120 pounds—in both cases considerably below the pressure specified for effective work. The author concludes: "It is entirely evident from the large amount of data from these five plats that the drenching spray has no particular advantage over the mist spray, except as it may deposit more material on the foliage and apple." The reason is held to be found in the condition of the calyx. In the West, as shown by the figures of Doctor Ball, the calyx cavity is still open two weeks after blossoming and by which time the stamen bars have shriveled. This condition for the East, in the case of the Baldwin apple, was found not to obtain, as the calyx lobes are closed in about one week or at the most ten days after blooming, while the stamen bars at this time are still turgid, preventing the enforcement of the spray into the inner calyx cup.

The report is a most creditable one and shows an enormous amount of detailed work on the part of Professor Sanderson and his assistant, Mr. Wilson, and his former assistant, Mr. T. J. Headlee, constituting a very valuable addition to our literature on this subject.

A. L. QUAINTANCE.

Fighting the Insect Pests and Diseases of Orchard, Field and Garden Crops, by H. L. Price. Va. Agric. Exp't Sta. Cir. 7, p. 1–112, 1909.

This new departure comprises a concise though comprehensive illustrated discussion of the principal insect pests and fungous diseases affecting field and garden crops.

The Report of the Entomologist, by C. W. HOWARD. Transvaal Dep't of Agric. Rep't. 1907–1908, p. 164–209, 1909.

This report gives a detailed account of the locust work and incidentally offers a striking illustration of the difficulties under which such operations may be conducted at times. The occasional necessity of drawing water for spraying purposes some twenty miles would appear like a severe hardship to American horticulturists. The extent of the locust work conducted by the Transvaal is illustrated by the expenditure of some $30,000 against the brown locusts. The value of this discussion is greatly increased by a series of maps showing the infested areas. A number of the more injurious insect pests are noticed briefly. There is an extended account, accompanied by

valuable experimental data, on methods of protecting wood from the ravages of white ants. The author's experiments indicate that solutions containing arsenic and also many of those composed in part of tar, creosote and carbolic acid compounds are excellent preventives against these pests.

Current Notes

Conducted by the Associate Editor

Professor C. F. Adams has been promoted to Dean of the College of Agriculture and Director of the Agricultural Experiment Station in the University of Arkansas. He will also continue in the Chair of Entomology in the University.

Mr. Paul Hayhurst has been appointed Assistant Entomologist in the above institution.

The following appointments have been made in the Bureau of Entomology, United States Department of Agriculture, since May 1:

Citrus Fruit Investigations, Mr. J. F. Zimmer.

Deciduous Fruit Investigations, W. Postiff, C. W. Hooker, E. J. Hoddy, E. W. Scott, J. R. Horton.

Forest Insect Investigations, Josef Brunner, T. E. Snyder.

Southern Field Crop Insect Investigations, T. C. Barber, W. H. Hoffman, Jr., T. E. Holloway, F. L. Elliott, W. V. King, O. M. Lander, V. I. Safro, George A. Runner.

Truck Crop and Stored Product Insect Investigations, Thomas H. Jones.

Gypsy Moth Investigations, C. W. Collins, W. R. Thompson.

Prof. Glen W. Herrick, Entomologist to the Texas Agricultural Experiment Station, has been appointed Professor of Entomology at Cornell University, vice Prof. M. V. Slingerland, deceased.

We regret to announce the recent death of M. Vallery-Mayet at Montpelier, France. He was an enthusiastic entomologist and owned a large and very valuable collection.

Mr. E. J. Krauss has resigned as assistant in the Bureau of Entomology and has accepted the position of Assistant Entomologist at the University of Washington, Pullman, Washington.

Dr. C. Gordon Hewitt, lecturer in economic zoölogy in the University of Manchester, Manchester, England, has been appointed Entomologist of the Dominion of Canada, vice Dr. James Fletcher, deceased.

Dr. H. B. Ward has resigned as Dean of the College of Medicine and Department of Zoölogy at the University of Nebraska to become Dean of the Department of Zoölogy at the University of Illinois.

The gypsy moth law in Massachusetts was amended at the recent session of the Legislature and the work on the gypsy and brown-tail moths was placed in charge of the State Forester, Prof. F. W. Rane. Mr. L. H. Worthley, who was assistant superintendent under the old law, has been appointed Assistant Forester in charge of Moth Work.

Dr. O. A. Johannsen, Instructor in Civil Engineering at Cornell University, has been appointed Entomologist at the Maine Agricultural Experiment Station.

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RELATION OF INSECTS TO HUMAN WELFARE[1]

By H. A. GOSSARD

Long ages before the earliest mammal appeared on earth multitudinous individuals representing diversified types of insect life had found congenial homes in prairie, forest and desert. if such terms may be correctly applied to landscapes differing in most respects from any which have ever been seen or named by human kind. Above the earth, on its surface, in its caves, and on and in its waters these creatures fed and multiplied as now. Well back towards the morning twilight of geological history, in the Silurian age, and in greater numbers in the Devonian, when the fishes represented the culminating point reached by the animal kingdom and a true forest vegetation for the first time clothed the youthful world, the types represented by

[1]The following paper was compiled by the writer for the information of the Century Club, a small association of literary, scientific and professional men of Wooster, O. The only merit, if any, to which the paper can lay claim is that of an example of popular writing that helps to mold a friendly sentiment among intelligent and influential men, and eventually brings enlarged resources for work and investigation to the economic entomologist. A careful scrutiny of the composition will disclose among the authorities and papers which have been drawn upon the following in particular, from which, in some cases, quotations have been made with but little or no change from the original text:

Second Report United States Entomological Commission on the Rocky Mountain Locust.

Review, in Science, by Doctor Howard of the History of Economic Entomology for Fifty Years.

The Gypsy Moth, by E. H. Forbush.

The Brown-Tail Moth, Fernald and Kirkland.

Flies and Ticks as Agents in Distribution of Disease, by F. V. Theobald.

The Economic Status of Insects as a Class, by Dr. L. O. Howard.